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## Original Communications

### A PRELIMINARY STUDY OF THE CYCLIC HISTOLOGIC CHANGES OF THE HUMAN CERVICAL MUCOSA IN THE INTERMENSTRUAL PERIOD\*

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THE cyclic function of the ovary results in the production of two distinct hormones, the action of which governs the physiologic histologic changes in the female genital tract. The hormone action of the developing and ripening follicle initiates new cell formations in the mucous membranes, and the hormone produced by the corpus luteum brings about changes necessary for the nidation of the ovum.

The cyclic histologic changes are most pronounced in the endometrium. Hitschman and Adler<sup>1</sup> were the first ones who subjected the endometrium to a systematic study, and their description of the cyclic events in that structure is universally accepted. Schroeder's<sup>2</sup> investigations of structural changes during actual menstrual bleeding supplemented our conception of this subject. The description of these findings stimulated a great deal of research work in animals and in the human being in an effort to find evidence of a menstrual cycle in other parts of the genital tract. Diercks<sup>3</sup> reported his observations on the human vagina, concluding that a definite cycle occurs. Although this report was followed by contradictory findings by others, Geist's,<sup>4</sup> and more recently Papanicolaou's<sup>5</sup> studies substantiate the presence of a vaginal cycle. Novak and Everett<sup>6</sup> proved that a definite histologic cycle occurs in the human tubal mucosa, although it is less conspicuous than that of the endometrium.

No definite data are available regarding the cyclic changes of the human cervical mucosa. R. Schroeder<sup>7</sup> and Nurenberger studied the isthmus of the uterus, and found that it participates in the cycle, but they contend that the cervical mucosa

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does not show any evidence of definite involvement, and this is now the generally accepted view (Meyer<sup>8</sup>). Novak,<sup>9</sup> in his recent review of the cyclic histologic changes in the female genital tract, makes the following statement: "Is there a histologic cycle in the cervix? A priori, we would expect that this would be the case, for the cervical mucosa is a derivative of the müllerian epithelium, like the epithelium of the uterus and tube, both of which show such characteristic histologic changes during the cycle. As yet, however, no clear-cut cycle has been described in the case of the endocervix."

The investigation of cyclic changes in cervixes of different animals did not yield uniform results. No cyclic change was found in mice and rats (Clauberg<sup>10</sup>); on the other hand Hartman and Olbers<sup>11</sup> describe a distinct cyclic change of the cervical epithelium in guinea pigs.

Not knowing whether or not the human endocervix takes part in the menstrual cycle makes the proper interpretation of presumably pathologic findings in the cervical mucosa problematical. That the endocervix is often the site of inflammatory changes is indisputable, but whether or not these findings merely represent a certain phase of the physiologic activity of the mucous membrane in some cases is questionable. In the era before Hitschman and Adler's studies, premenstrual congestion and increased glandular activity were considered pathologic and were credited as the basis for irregular bleedings or profuse discharge. Unless the physiologic activity of the endocervix is known, similar errors may also be made in the interpretation of structural changes of the cervical mucosa. If hormonal influence on the endocervix can be proved, changes which are now considered as being due to local pathologic causes might be demonstrated as manifestations of hormone overproduction.

A study of the cyclic changes in the human endocervix presents certain difficulties. A histologic comparison of cervixes after surgical removal or after autopsies would not furnish reliable data. The structure of the endocervix is more subject to individual variations than that of the endometrium.

In an attempt to study the physiologic activity of the endocervix, I employed a method which made it possible to obtain periodically specimens of cervical mucosa from the same patient. In this series of cases two specimens were taken from each patient at two-week intervals. The cutting current of the high frequency machine with the Hyams cervical electrode was used. A detailed description of the instrument, and directions for its proper use, may be found in Hyams' article on cervical conization.<sup>12</sup> The patient does not require any special preparation. She is placed on the examining table, the cervix is exposed with a bivalve speculum, and the portio and cervical canal are wiped dry. The active electrode can be inserted into the canal to the internal os without previous dilatation. The current is turned on, and by a rotating motion of the operator's hand a portion of the cervical mucosa is excised. A stripe approximately 3 mm. wide extending from the external to the internal os is thus obtained and prepared for histologic examination. In some cases there may be a slight oozing from the cervical canal after the procedure, which can always be controlled by simple vaginal packing. No anesthesia is necessary. Some patients experience a burning



discomfort during the cutting, which promptly disappears after the excision has been completed. I never observed any untoward after effects, and the patient may continue her usual activities. In very sensitive patients, surface anesthesia with cocaine or metycaine may be employed. Ten to fifteen days after the first specimen is excised the procedure is repeated and the two specimens histologically compared. Precautions are taken to eliminate possible errors in the histologic interpretation of the two specimens, due to secondary local reaction after the first cutting. The specimens are always taken from two remote corners of the cervix. When the first one is removed from the left upper corner, the second one is removed from the right lower corner. Furthermore, the first specimen is taken preferably in the premenstrual

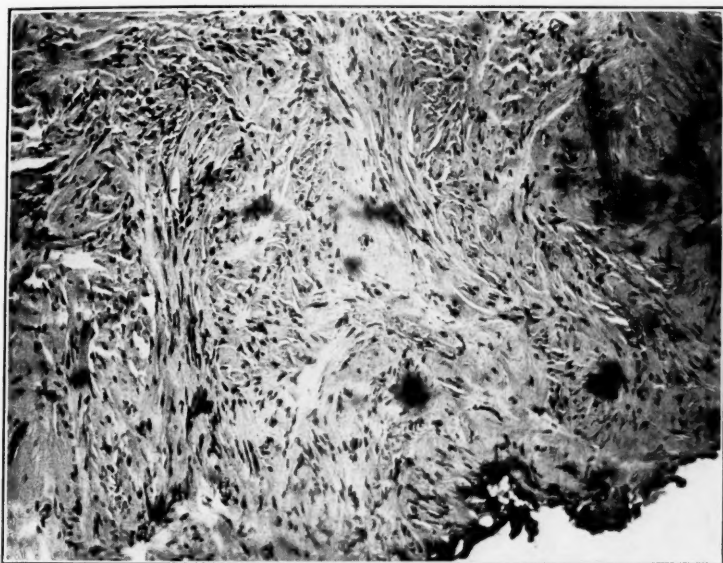


Fig. 1.—Visualizing under high power the postmenstrual stroma characterized by its density.

period, when a physiologic congestion of the tissue is to be expected, and this is followed by the removal of a second specimen in the postmenstrual period.

My observations on nine patients with eighteen specimens form the basis of this study. Eight of the cases were patients between the ages of twenty-seven and thirty-six, all nulliparas, with normal menstrual histories and apparently normal cervixes. In one case observations were made after operative removal of the ovaries.

CASE 1.—A thirty-one-year-old woman, never married, never pregnant, had her first menstruation at the age of fourteen, recurring regularly at twenty-eight-day intervals, three days' duration, moderate bleeding without pains. On vaginal examination, a normal uterus was found in good position, freely movable, adnexa

negative. Through the speculum an apparently normal cervix was visualized. The first specimen was taken twenty-four days after the patient's menstruation. Five days later she began to menstruate, which was the expected date of her next period.

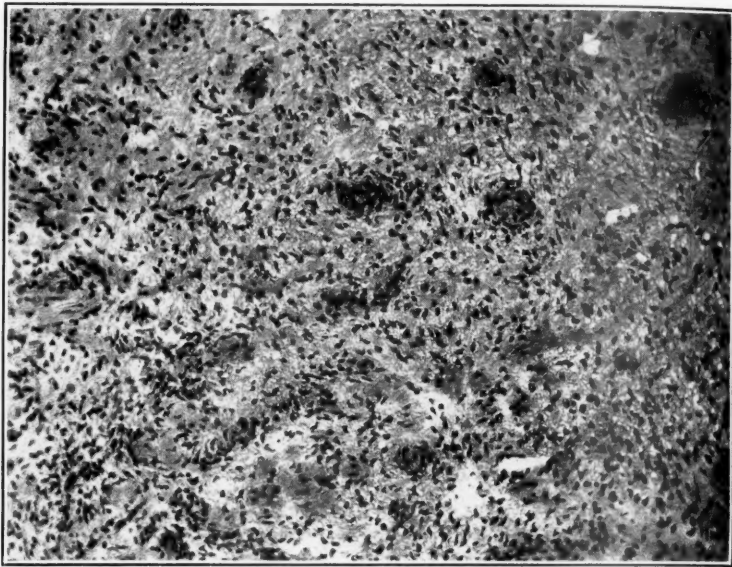


Fig. 2.—Giving the high power picture of the markedly loose and vascularized stroma of the premenstrual phase.

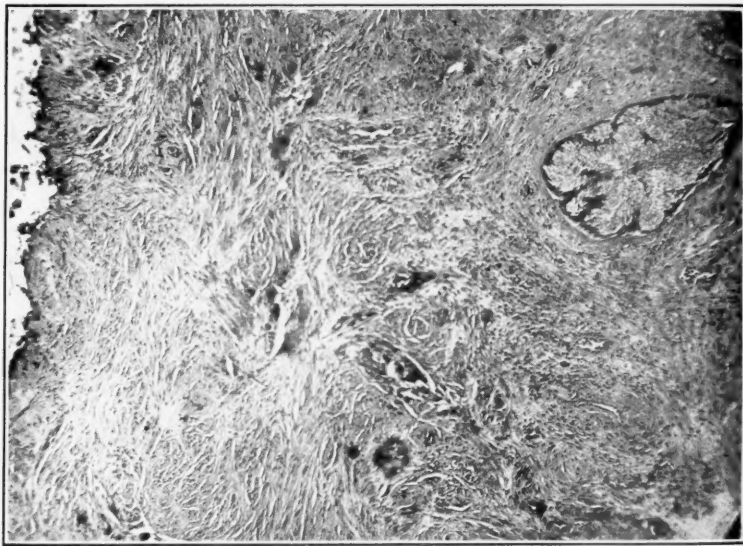


Fig. 3.—Picture of a typical postmenstrual gland under low power. In no portion of this specimen could I get more than two glands in the field under low power.

The second specimen was obtained six days after her first day of menstruation. The histologic study of these specimens revealed a marked structural difference. The postmenstrual specimen showed a dense stroma with scattered small points of

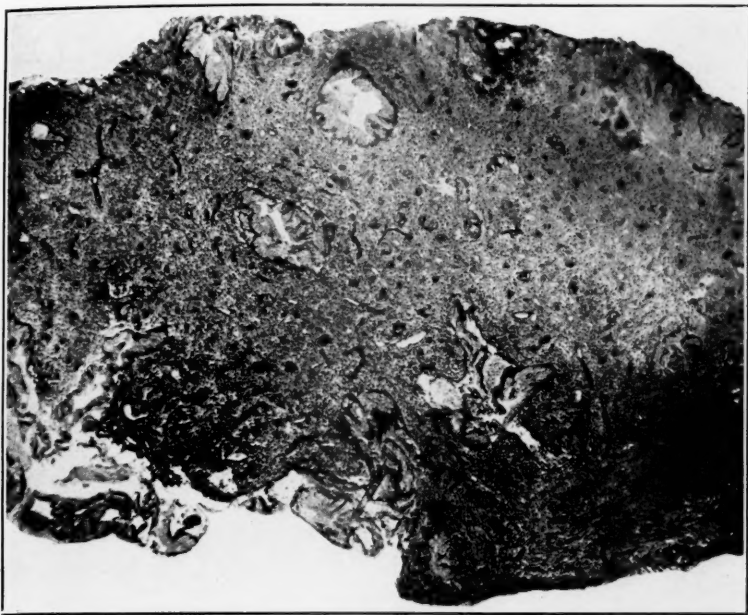


Fig. 4.—Picture under low power, which demonstrates the increase in the number of glands and their variations in size and shape in the premenstrual specimen.

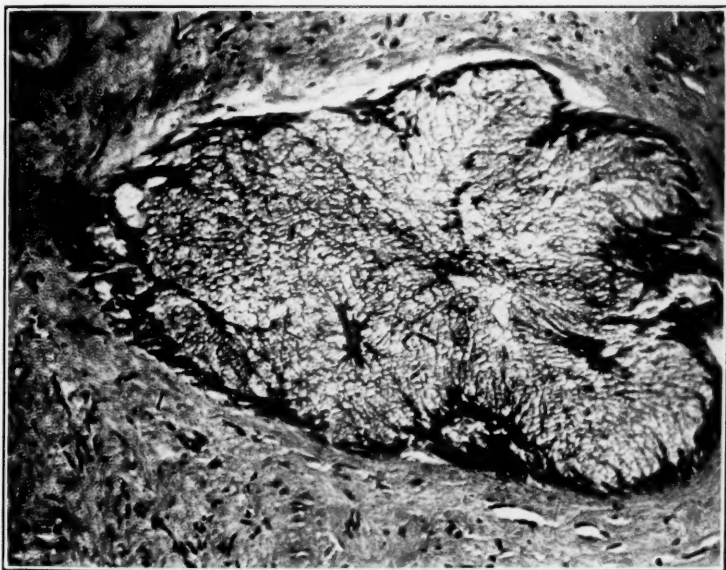


Fig. 5.—Showing the postmenstrual gland under high power. The epithelial lining is low, consisting mostly of one row of cells. There is ample mucus production.

granulation tissue. The glands had a regular outline, were round or oval shaped, and were scanty and widely spaced. The gland epithelium showed little cytoplasm and one row of small nuclei close to the basal line. In the premenstrual specimen, the stroma was well vascularized and contained many engorged small blood vessels. There was an increased cellularity of the entire cervical tissue. The number of glands was considerably larger, and there was a great variety in their shape and size. There was also considerable folding of the epithelial lining and digit-like projections into the surrounding tissue. The amount of mucus in the glands was reduced and more cytoplasm was present. Nuclei were also more numerous and many were cut longitudinally, showing rod shape.

The cyclic histologic changes in this case are demonstrated in Figs. 1 to 6.

CASE 2.—A thirty-five-year-old woman, single, never pregnant. She began to menstruate at the age of thirteen, was always regular at twenty-eight-day inter-

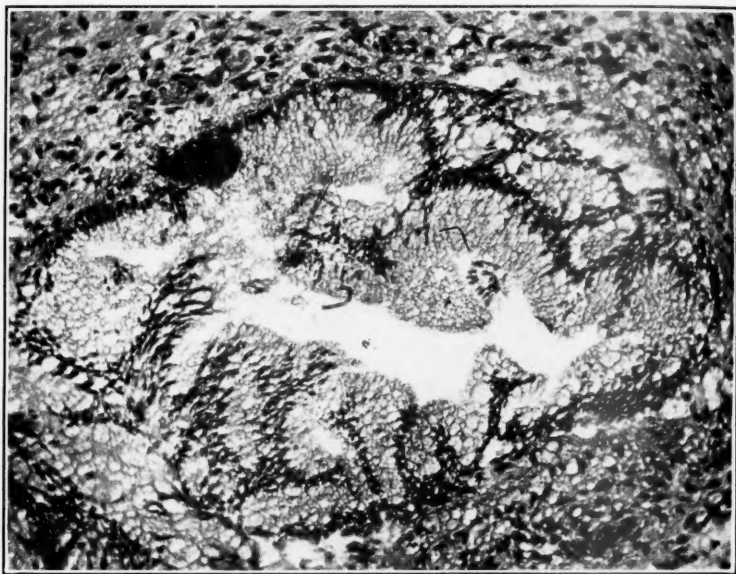


Fig. 6.—Picture of a gland under high power in the premenstrual specimen. There is an evidence of epithelial proliferation in the gland with reduced mucus production.

vals, the bleeding lasting five days, moderate in amount. No history of any genital disease. On vaginal examination a normal uterus and adnexa were palpated. The first specimen was taken fifteen days after the first day of a menstrual period. The histologic findings of this specimen were: the cervical canal was lined by a layer of columnar epithelium with many eosinophiles. The stroma was loose and hyperemic, was infiltrated by leucocytes, mononuclear cells, and eosinophiles. There was a great abundance of glands with folding epithelium and ample mucus production. The nuclei of the epithelium were at the base and in part in the midzone of the cells. The second specimen was taken during the menstrual flow, twenty-four hours after its onset. The histologic picture of this specimen presented a sharp contrast to the first one. The cervical canal was denuded for the most part of lining epithelium. Several layers of exfoliated epithelium covered the surface. The stroma often separated with the epithelium in process of exfoliation. The gland lining epithelium was often in several layers with nuclei at various levels with abundant exfoliation. The exfoliation transformed some of the glands into cysts, prac-



tically without glandular structure. The periglandular stroma was infiltrated by lymphocytes and was edematous where the cervical epithelium was being exfoliated. Figs. 7 and 8 illustrate these changes.

The investigation of four additional cases with eight specimens gave similar evidences of a cyclic histologic process in the endocervix.



Fig. 7.—Showing the picture of the surface epithelium, stroma, and glands under low power fifteen days after menstruation.

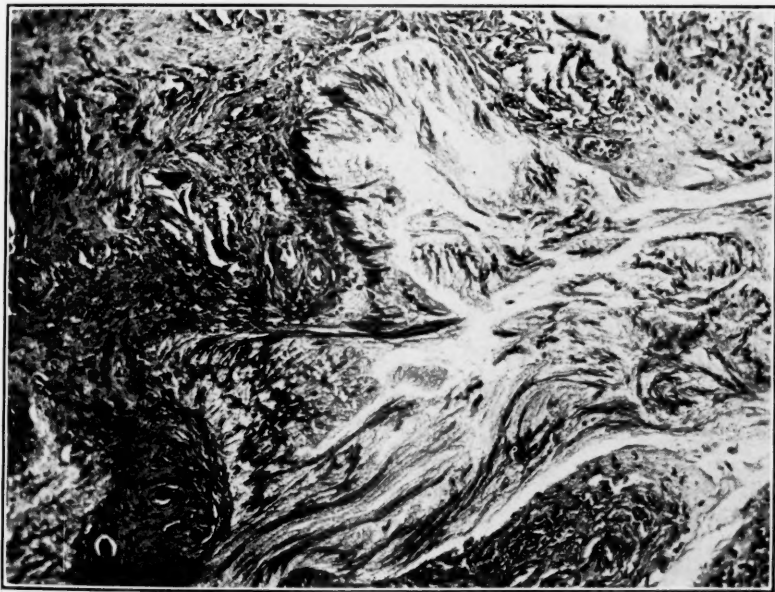


Fig. 8.—High power visualization of a gland during menstruation. Part of the gland is denuded of its lining epithelium, in another part the process of exfoliation is seen and the lumen is filled with exfoliated cells.

In the following case the cervical mucosa was subjected to a periodic study following the operative removal of the ovaries:

CASE 7.—A thirty-two-year-old woman with multiple large fibroids came under observation after a typical supravaginal hysterectomy with removal of the ovaries. The patient made an uneventful recovery and left the hospital on the twelfth post-operative day. Eight weeks later I took a specimen of the cervical mucosa, which revealed atrophic glands surrounded by sclerosed connective tissue. A specimen taken two weeks later gave exactly the same histologic picture. No evidence of any cellular activity could be seen in comparing the two specimens. Fig. 9 gives the low power picture of the cervical tissue in this case. The repeated histologic studies in this case seem to indicate that the removal of the ovaries causes atrophic changes in the cervical mucosa, with complete lack of evidence of glandular stimulation. The observation made on the human endometrium, that the ovary governs the cyclic phases of the mucous membrane, is apparently true also for the endocervix.

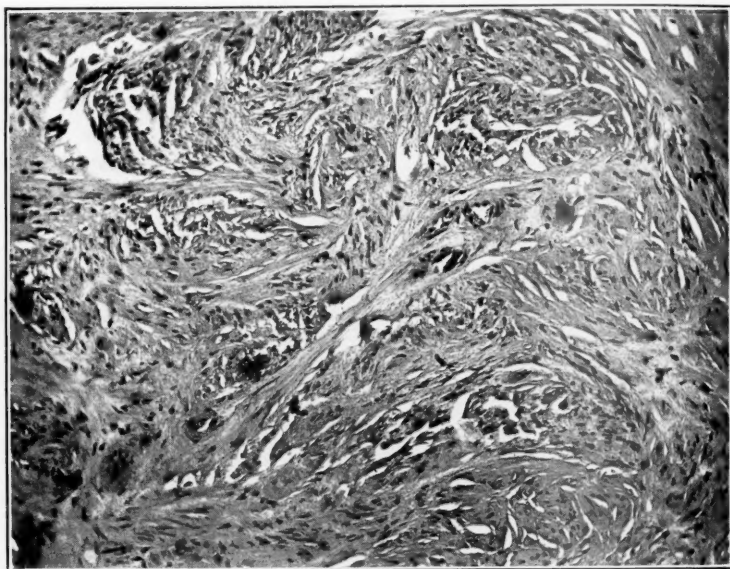


Fig. 9.

In two cases of this series no definite cyclic change could be ascertained. In both a more or less constant activity of the tissues was noted, which was only slightly accentuated in the premenstrual period. One of these patients subsequently had to undergo an abdominal operation, which afforded an opportunity to investigate the ovaries histologically in this atypical case, a report of which follows:

CASE 9.—A thirty-one-year-old woman had been married for thirteen years, but had never become pregnant. She always menstruated at irregular intervals, every three to five weeks, with a duration of three to four days' moderate amount of bleeding, with occasional pains during the first two days. Vaginal examination revealed a normal cervix; the uterus was found moderately enlarged, firm, in good position, and freely movable. A small fibroid was palpable in the fundus and another one in the right wall of the corpus. Tubes and ovaries could not be felt. A specimen of the endocervix was taken eight days after the first day of her last menstruation. The histologic findings were the following: there were large and numerous glands present, many of which showed projections into the surrounding



tissue, although others had a perfectly round or oval shape. The nuclei were rod-shaped and fairly numerous. In parts there was a marked exfoliation. The stroma was vascular and edematous in places. The second specimen was taken eleven days after the first one, and five days later the patient began to menstruate. The histologic findings of the second specimen were: the glands were abundant, in part they were hyperplastic and filled with papillas of lining epithelium with nuclei at various levels and with exfoliation. In part, however, the glands were small and compact and were lined by columnar epithelium with deep-staining nuclei at the base and pink staining cytoplasm. The stroma was quite edematous and showed congested blood vessels.

Four months after having examined these specimens, the patient returned complaining of loss of appetite and insomnia. She was worried about her fibroids and insisted on immediate operation.

I therefore performed a supravaginal hysterectomy with removal of the adnexa, twenty-one days after the first day of her previous menstruation. The pathologic report on the extirpated organs was made by Dr. H. L. Meeker: Specimen was a uterus which had been amputated above the cervix, and both tubes and ovaries were attached. The uterus had been opened, disclosing a somewhat edematous and hemorrhagic endometrium lining a canal 50 mm. in length. The myometrium was 22 mm. in thickness, and there was an intramural fibroid 16 mm. in diameter, and beneath the serosa there was a second 20 mm. in diameter. The first tube measured 70 mm. in length, and had a proximal diameter of 4 mm. widening to 12 mm. at the fimbriated end which was free. On section the lumen was patent throughout, and the plicae well formed. The second tube measured 75 mm. in length, had a proximal diameter of 4 mm. and 12 mm. at the fimbriated end which was free. This tube was precisely similar to the first described. The first ovary measured 42 by 27 by 22 mm. It was partly firm, white, and partly bluish and cystic. On section there were several corpora lutea 2 to 3 mm. in diameter. They were filled with reddish jelly. There were also small graafian follicle cysts a few millimeters in diameter, embedded beneath the surface. Second ovary measured 30 by 27 by 22 mm. This contained numerous graafian follicle cysts, the largest 6 mm. in diameter. They were filled with reddish jelly. *Microscopic:* Sections of the uterus including the mucosa showed the endometrium lined by one or two layers of columnar epithelium. The endometrial glands were elongated and tortuous, and some of them slightly dilated and containing coagulated serum. They were lined by several layers of columnar epithelium. The interglandular stroma was relatively decreased but actually hyperplastic. It was very edematous and especially near the surface was suffused with red blood cells, the picture suggesting a premenstrual phase. Sections of the fallopian tubes showed elaborate branching plicae covered by one or two layers of columnar epithelium. The stroma of the plicae was fibrous tissue diffusely infiltrated by lymphocytes and plasma cells, and its many blood vessels contained excess number of polynuclear leucocytes. Sections of the ovary showed numerous small graafian follicles embedded in the cortex. There were also dilated graafian follicles forming the cysts noted in the gross and lined by several layers of epithelium. In addition there were corpus luteum cysts lined by many layers of pale lutein cells. The enclosed blood clot showed beginning organization at the periphery.

In this case the coexistence of an atypical activity of the cervical mucosa with distinct ovarian pathology deserved attention.

#### SUMMARY

Nine patients were studied with periodic tissue examinations of the cervical mucosa. In six cases evidence of a definite histologic cycle could be determined. In one case, after operative removal of the

ovaries, atrophic changes and inactivity of the endocervix were found. In two cases the presence of a typical histologic cycle could not be established. One of these cases revealed definite ovarian pathology at subsequent operation.

The number of cases is too small to justify a final conclusion on the histologic cycle of the cervical mucosa. The chief purpose of this paper is to suggest a method which permits periodic histologic investigations of the endocervix in patients. It is a simple office procedure, does not require anesthesia, and provided it is done in the absence of any inflammatory process in the genital tract, it is harmless and without unpleasant after effects. It has been my experience that the raw surface in the cervical canal becomes completely epithelialized in about six weeks. A periodic tissue examination, therefore, can be repeated in the same patient at two- or three-month intervals.

Dr. Max Goldzieher, Endocrinologist to the Gouverneur Hospital of New York City, cooperated with me in making the interpretation of the microscopic slides, and I wish to express my thanks for his valuable suggestions.

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116 EAST SIXTY-EIGHTH STREET

#### **Murphy, Douglas P.: Reproductive Efficiency Before and After the Birth of Malformed Children, Surg. Gynec. Obst. 62: 585, 1936.**

The reproductive activity of 405 mothers, each having had a congenitally malformed child, is reported with respect to the incidence of miscarriages, stillbirths, and premature births. Of the 405 families, 151 exhibited one or more miscarriages, stillbirths, or premature births. Of the total of 1,732 conceptions in the 405 families, 63.2 per cent ended normally, 23.4 per cent resulted in malformed children, and 13.4 per cent ended in either miscarriage, stillbirth, or premature birth.

Miscarriages, stillbirths, and premature births occurred more often than would be expected by chance in the pregnancies immediately preceding and immediately following the pregnancy which resulted in the birth of the defective child, and less often than would be expected by chance in the remaining pregnancies. Miscarriage, stillbirth, and premature birth occurred most often in the pregnancy immediately preceding that of the defective child.

It is concluded that the birth of a congenitally malformed child may be only one expression of a prolonged decrease in functional reproductive activity, the other expressions being miscarriages, stillbirths, and premature births.

It is suggested that the obstetrician has unusual reason to suspect the possible existence of a congenital malformation in the pregnancy which follows immediately after a miscarriage, a stillbirth, or a premature birth.

WM. C. HENSKE.

## THE ACID-BASE BALANCE OF THE BLOOD DURING NORMAL PREGNANCY AND PUERPERIUM\*

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THE fact that the acid-base balance of the blood may undergo a slight disturbance during normal pregnancy has been recognized for some time. Upon examining the literature, however, one is impressed by the relatively few studies which have been reported dealing with complete acid-base balance changes. This is particularly true for observations extending throughout the course of pregnancy. That is, most of the publications have consisted in a comparison of the results obtained at or near term with those obtained postpartum.

The results of the more recent studies in which a comparison of the antepartum and postpartum acid-base balance changes in normal pregnancy have been made are summarized in Table I. It will be observed that a lowering of the bicarbonate concentration has uniformly been found by all the workers, and this is equally true for the total base concentration where it was determined. The chloride concentration remains essentially unchanged and the pH appears to vary within normal limits.

No explanation can be given at the present time for the lowering of the bicarbonate concentration which is entirely free from criticism. Since there is evidence<sup>5</sup> that the blood pH (principally colorimetrically determined pH values) is not infrequently in the upper range of normal and in some instances slightly above normal, Muntwyler, Limbach, Bill and Myers,<sup>6</sup> for want of a better explanation, accepted the view expressed by Austin and Cullen<sup>7</sup> that hyperventilation is the main cause of the bicarbonate decrease. This view has been subjected to considerable criticism.<sup>8</sup>

The object of the present study was twofold: first, to ascertain how early in pregnancy the acid-base changes of the blood become manifest, and second, since the colorimetric pH values have been questioned, to compare the colorimetric and electrometric pH values in a series of cases.

### METHODS

The present work was carried out in series on each of 33 normal pregnant women from the second or third month of pregnancy to the first and second month postpartum. Twelve additional normal pregnancies were studied only during delivery

\*For lack of space the extended tabulations cannot be included here but may be found in the authors' reprints.

TABLE I. A COMPARISON OF THE ANTEPARTUM AND POSTPARTUM CHANGES OF THE ACID-BASE BALANCE OF THE BLOOD IN NORMAL PREGNANCY

	NUMBER OF OBSERVATIONS*	pH	HCO <sub>3</sub> m.Eq.	Cl m.Eq.	PROTEIN m.Eq.	TOTAL BASE m.Eq.	PH METHOD EMPLOYED	AUTHOR AND DATE
Antepartum	55	7.44	20.5	107.6			Colorimetric	Gaebler and Rosene, <sup>1</sup> 1928
Postpartum	30	7.41	24.2	107.8		146.1		Oard and Peters, <sup>2</sup> 1929
Antepartum	12		22.1	103.7	15.2	151.2		Stander et al., <sup>3</sup> 1930
Postpartum	3		26.0	102.6	17.2	147.0	Electrometric	Dieckmann and Wegner, <sup>4</sup> 1934
Antepartum	3	7.37	20.7	104.0	14.1	152.6	Colorimetric	
Postpartum	4	7.34	25.4	106.6	16.4	153.3		
Antepartum	100	7.39	22.1	103.4		147.1	Electrometric	
Postpartum	80	7.39	22.5	103.1	14.4	159.0		
Antepartum	120	7.41	22.1	102.8	15.6			
Postpartum	65	7.42	25.3	102.6				

In a number of instances the data have been recalculated to terms of m.Eq. The figures given in the table are means, except for data of Oard and Peters, and Stander et al., where averages are used.

\*Maximum number of observations.

and hospital confinement. The blood samples for each group of determinations were drawn under oil and without stasis. With the exception of those taken during labor, when the time and preceding exercises could not be regulated, the blood was obtained before the patient had risen or had had breakfast. As soon as the blood had clotted, it was centrifuged and the serum removed without air contact. The pH was determined both colorimetrically at room temperature and electrometrically with the hydrogen electrode at 38° according to the procedures previously outlined.<sup>9, 10</sup> The estimations of the CO<sub>2</sub> content, total base, chloride and total protein were made according to the methods already described.<sup>6</sup>

#### DISCUSSION

The results of all of the acid-base balance determinations are tabulated in the appendix (Table III) where individual variations for each case can be followed. Table II gives the results which were obtained when the various values were averaged according to the month of pregnancy. From these average values it can be seen that there is no general trend in the change of the acid-base balance concomitant with the progress of pregnancy. The changes which occur appear to have been established before the third month of pregnancy. A statistical analysis of the data is included in Table II.

The significant electrolyte changes which appear when a comparison of the average antepartum and postpartum values is made are: an increase of bicarbonate from 23.1 to 25.3; total protein from 14.4 to 15.6; total acid from 140.3 to 143.6; and total base from 147.1 to 150.0 m.Eq. The chloride concentration remains unchanged. These observations are in accord with those of previous workers shown in Table I, excepting those of Dieckmann and Wegner,<sup>4</sup> where the changes are relatively small. Similar changes were also observed by Muntwyler, Limbach, Bill and Myers<sup>6</sup> in a study of the acid-base balance changes in mild "toxemias" of pregnancy. In their work, however, the average chloride concentration was found to be 2.0 m.Eq. less in the postpartum samples (taken within two weeks following delivery) than in the antepartum samples.

The average antepartum and postpartum pH values (both colorimetric and electrometric) are comparatively constant and are slightly above the normal average of 7.4. Elsewhere we have stated<sup>11</sup> that "as a result of a large number of observations made on human plasma by the electrometric and colorimetric methods, we feel that the normal pH generally falls between 7.35 and 7.45, with an average of 7.4."

The distribution of the antepartum acid-base balance which represents 93 electrometric pH determinations on 44 normal pregnancies is shown in Fig. 1.

It will be observed that there is considerable scattering with six values (representing six cases) occurring above pH 7.45 and three values (representing three cases) occurring below 7.35. (It is only fair to note that 2 of the 44 cases, in which

TABLE II. INTERVAL AVERAGES OF THE ACID-BASE EQUILIBRIUM THROUGHOUT THE ANTEPARTUM AND POSTPARTUM PERIODS

INTERVAL	NO. DETN.	pH <sub>e</sub> *	pH <sub>e</sub> *	-HCO <sub>3</sub> m.Eq.	-Cl m.Eq.	PROTEIN m.Eq.	TOTAL ACID m.Eq.	TOTAL BASE m.Eq.	UNDETN. ACID m.Eq.
<i>Antepartum:</i>									
8 mo.	4	7.42	7.47	22.7	101.1	14.0	137.8	142.7	4.9
6 and 7 mo.	23	7.39	7.39	23.3	102.2	14.4	139.8	145.5	5.7
4 and 5 mo.	26	7.41	7.425	23.2	103.5	14.5	141.2	148.1	6.9
2 and 3 mo.	28	7.41	7.42	23.7	102.8	14.3	140.3	145.7	5.4
1 mo.	23	7.41	7.40	23.3	101.7	14.7	139.7	147.0	7.3
2 days	9	7.42	7.445	22.1	104.0	14.9	141.0	146.1	5.1
In labor	13	7.395	7.41	22.1	102.7	14.9	139.7	149.1	9.4
<i>Postpartum:</i>									
3 days	11	7.41	7.40	24.7	103.5	14.7	142.9	150.2	7.3
7 days	21	7.41	7.40	25.0	102.2	16.1	143.3	149.7	6.4
1 mo.	19	7.41	7.40	25.3	101.9	15.5	142.7	150.6	7.9
2 to 7 mo.	14	7.41	7.41	26.6	102.6	15.8	145.0	149.0	4.0
Mean antepartum		7.411	7.426	23.1	102.8	14.4	140.3	147.1	6.8
Mean postpartum		7.416	7.403	25.3	102.6	15.6	143.6	150.0	6.4
Difference of means		0.005	0.0253	2.2	0.24	1.16	3.3	2.9	
Error of difference		0.0036	0.0055	0.172	0.319	0.169	0.357	0.485	
Ratio D/E		1.5	0.5	12.7	0.75	6.8	9.2	6.0	

\*pH<sub>e</sub> stands for electrometric pH and pH<sub>e</sub> for colorimetric pH in this and Table III.



electrometric pH determinations were not made, showed high colorimetric pH values.) A similar distribution employing colorimetric pH values shows a somewhat greater scattering. In the series of 109 colorimetric determinations obtained upon the same 44 cases the pH value is greater than pH 7.45 in 21 instances (representing 16 cases), and below pH 7.35 in 11 instances (representing 9 cases). By employing a colorimetric correction of 0.30 pH to convert the colorimetric serum pH from 20° to 38° a comparison of 77 simultaneous colorimetric and electrometric determinations made upon the antepartum bloods of the above cases showed the colorimetric value to be within  $\pm 0.02$  pH, 33 times (43 per cent), and within  $\pm 0.04$  pH, 52 times (68 per cent). The agreement between the colorimetric and electrometric values in these cases is not as good as was obtained by us previously<sup>9</sup> when plasma was employed. In the latter study 85 per cent of the plasma colorimetric pH values were within  $\pm 0.04$  pH of the correct value when a colorimetric

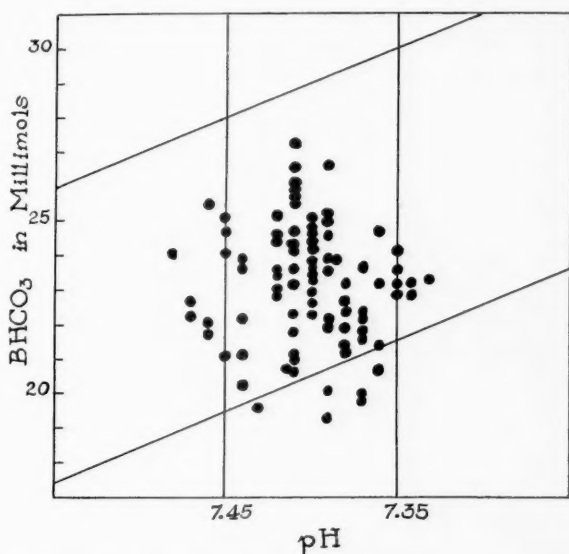


Fig. 1.—The distribution of the antepartum acid-base equilibrium in Van Slyke's graph. The pH boundaries have been narrowed to 7.45 to 7.35.

correction of 0.22 pH was employed. The reason for this difference in results is not apparent. One might infer that by the use of serum instead of plasma the colorimetric correction is less reliable. It was probably unfortunate that we did not use plasma in this study, since the colorimetric pH observations of Gaebler and Rosene<sup>1</sup> and Muntwyler, Limbach, Bill and Myers<sup>6</sup> were carried out with plasma, but it was not realized that serum would require a different correction factor than plasma until the study was well under way, and the poorer agreement with the electrometric pH observations was not appreciated until the study was nearly completed.

In Fig. 1 it will be observed that the points tend to concentrate in the lower half of area 5 of Van Slyke's diagram.<sup>12</sup> This cannot be considered as more than a tendency toward a compensated alkali or CO<sub>2</sub> deficit.

TABLE III. ACID-BASE DETERMINATIONS DURING PREGNANCY

CASE	AGE	PARA	MO. OF PREG.*	pH <sub>e</sub>	pH <sub>c</sub>	CO <sub>2</sub> m.Eq.	-Cl m.Eq.	BASE m.Eq.	PROTEIN m.Eq.
1	19	i	4	7.39	7.39	24.8	106.2	150.1	
			6	7.41	7.43	23.4	100.5	150.0	6.8
			8½	7.45	7.37	22.2	102.1	154.4	7.2
			9	7.41	7.46	22.1	98.2	146.9	7.3
			+ 1 wk.	7.43	7.40	26.0	102.0	150.5	6.6
			+ 1 mo.	7.45	7.44	25.7	103.1	157.3	6.5
2	19	i	3½	7.42	7.37	25.7	102.8	149.7	5.9
			6	7.42	7.44	26.3	103.1	153.3	5.2
			-10 hr.	7.44	7.38	21.3	104.5	152.0	5.6
			+ 1 mo.	7.44	7.38	28.5	101.5	160.0	6.5
3	16	i	4	7.40	7.36	25.0	104.5	148.8	5.7
			6	7.42	7.44	24.8	106.1	153.7	6.0
			8½	7.39	7.39	23.2	107.1	143.3	5.0
			+ 1 mo.	7.42	7.34	29.2	102.8	156.6	6.0
4	32	i	3½	7.38	7.36	23.1	102.9		5.0
			6		7.46	22.0	106.9	149.5	5.0
			9	7.47	7.47	23.5	105.5	157.7	5.3
			+ 1 wk.	7.40	7.44	24.8	104.0	153.9	6.1
			+ 1 mo.	7.46	7.47	24.7	105.6	146.2	6.1
5	24	vii	3	7.38	7.35	24.4	103.7	140.0	6.4
			7		7.35	24.5	103.6	148.3	6.5
			8½	7.34	7.34	24.4	104.8	151.1	6.6
			+ 1 mo.	7.42	7.33	27.4	102.2	153.3	6.5
6	34	ii	4½	7.44	7.46	25.8	103.5	146.7	5.6
			6	7.41	7.42	24.8	104.4	152.6	5.6
			9	7.36	7.37	26.0	103.1	150.3	5.8
			+ 1 wk.	7.38	7.40	29.2	98.8	149.6	6.1
			+ 1 mo.	7.41	7.38	28.1	104.4	155.0	5.6
7	26	i	3	7.43	7.42	20.5	106.0	148.8	5.3
			6	7.46	7.45	22.8	105.2	151.7	5.4
			8	7.44	7.42	24.4	104.2	157.5	5.3
			+ 1 wk.	7.41	7.45	24.9	103.0	144.4	6.1
			+ 1 mo.		7.37	25.3	105.1	143.7	5.6
8	19	i	3	7.39	7.33	21.1	103.1	144.2	5.5
			6	7.40	7.39	25.5	104.0	147.6	
			9	7.40	7.39	24.1	103.7	156.0	5.7
			+ 3 days	7.44	7.38	23.1	99.8	148.5	5.8
			+ 1 mo.	7.42	7.47	26.1	105.2	152.8	5.7
9	30	ii	4		7.36	23.4	103.1	144.1	6.3
			7		7.42	22.4	104.1	149.2	
			9		7.37	25.5	101.0	153.4	5.7
			+ 1 wk.	7.40	7.38	26.0	100.5	157.4	7.1
			+ 1 mo.			28.4	103.7	144.2	6.3
10	24	ii	4	7.41	7.42	22.9	105.4	149.0	
			7	7.39	7.44	23.2	103.6	146.4	6.3
			- 1 day			21.7	103.3	141.7	6.2
			+ 1 wk.	7.43	7.39	26.7	102.8	142.5	6.6
			+ 3 mo.	7.37	7.38	28.9	102.5	154.5	7.0

\*Time immediately antepartum is indicated by a minus sign, and time postpartum by a plus.

TABLE III—CONT'D

CASE	AGE	PARA	MO. OF PREG.*	pH <sub>e</sub>	pH <sub>e</sub>	CO <sub>2</sub> m.Eq.	-Cl m.Eq.	BASE m.Eq.	PROTEIN m.Eq.
11	27	i	4		7.37	25.3	100.1	149.2	5.6
			6	7.41	7.38	21.7	102.2	151.0	6.3
			- 2 days		7.43	22.7	107.2	141.0	
			+ 2 mo.	7.39	7.39	25.6	103.2	151.7	
12	18	i	4	7.36	7.39	24.5	102.5	149.2	5.4
			7	7.40	7.46	23.4	104.7	153.5	4.8
			8	7.44	7.40	22.7	100.1	147.9	4.9
			9	7.42	7.39	24.1	102.0	144.2	4.9
			+ 2 mo.	7.38	7.42	27.0	101.6	147.0	5.3
13	34	vi	2	7.39	7.48	24.6	102.6	143.5	4.5
			6	7.45	7.43	25.1	102.9	148.0	5.7
			7		7.37	22.9	100.9	138.9	
			8	7.42	7.45	24.2	103.5	145.5	5.4
			9	7.43	7.33	24.5	101.2	146.3	5.7
			- 7 hr.		24.1	101.3	140.7	6.0	
			+ 1 wk.	7.35	7.36	25.7	103.0	149.3	6.1
			+ 1 mo.	7.43	7.48	28.5	100.3	145.5	
14	23	i	6	7.36	7.44	21.8	103.0	151.7	7.1
			8	7.38	7.44	23.8	101.7	146.7	6.1
			9		7.34	22.3	102.7		
			+ 2 mo.	7.42	7.32	29.3	100.0	148.4	6.6
15	33	vi	4	7.39	7.44	22.6	106.4	146.4	5.6
			8	7.37	7.42	22.7	103.5	148.4	5.5
			9	7.46	7.49	23.1	100.3	142.7	5.7
			2 days	7.44	7.47	24.3	103.4	144.6	5.6
			1½ mo.		7.49	26.0	100.2	144.5	6.3
16	30	iv	5	7.35	7.39	24.1	104.7	146.9	5.2
			7	7.40	7.34	24.6	100.8	148.4	5.4
			8	7.38	7.37	25.1	103.1	144.9	5.7
			9	7.45	7.47	26.2	99.0	145.9	5.7
			- 3 hr.	7.39		26.6	98.7	148.8	5.6
			+ 1 mo.	7.41	7.44	27.5	96.2	148.4	
17	19	iii	4	7.44	7.43	25.0	102.4	146.3	5.8
			7	7.41	7.40	25.5	99.5	145.6	5.2
			9		7.53	24.8	98.0	140.9	5.3
			+ 1 wk.	7.44	7.44	27.5	97.0	147.6	
			+ 7 mo.	7.43	7.48	28.4	101.0	153.8	7.4
18	20	i	5	7.40	7.38	24.5	99.8	140.4	5.8
			7		7.38	26.3	99.5	148.4	5.5
			9	7.46	7.50	26.6	104.0	140.3	5.4
			+ 2 mo.	7.41	7.38	28.3	99.3	141.5	4.7
19	21	i	4	7.39	7.39	26.4	99.0	142.9	5.9
			7	7.39	7.43	25.1	99.0	148.4	5.5
			8	7.48	7.50	25.1	100.6	143.8	5.6
			9			20.5	102.4	140.0	4.8
			+ 1 mo.	7.40	7.41	26.1	94.5	147.6	6.5
20	33	iv	5	7.33	7.40	24.7	104.7	144.0	5.3
			7	7.42	7.40	24.6	104.1	147.1	4.7
			8	7.47	7.53	23.3	103.1	146.3	4.5
			9		7.40	25.9	98.8	141.3	
			+ 2 mo.	7.41	7.44	27.6	109.1	151.0	5.4
21	25	ii	4		7.30	25.0	100.0	138.0	6.6
			7		7.33	26.5	101.9	156.1	5.5
			9		7.34	26.1	92.6	142.4	5.8
			+ 1 mo.	7.41	7.46	28.1	106.9	144.8	5.5

TABLE III—CONT'D

CASE	AGE	PARA	MO. OF PREG.*	pH <sub>e</sub>	pH <sub>c</sub>	CO <sub>2</sub> m.Eq.	-Cl m.Eq.	BASE m.Eq.	PROTEIN m.Eq.
22	18	ii	2		7.46	23.8	102.2	146.2	4.9
			4	7.41	7.42	26.3	96.9	140.0	5.7
			7	7.39	7.38	27.0	102.4	141.5	5.7
			8	7.41	7.44	25.9	104.3	145.0	
			9	7.41	7.44	24.3	104.7	145.0	
			+ 2 mo.	7.40	7.44	27.8	101.0	153.0	6.1
23	16	i	3	7.41	7.43	26.8		144.8	
			7	7.41	7.45	26.9	109.2	146.5	
			- 7½ hr.	7.40		25.9	104.5	158.0	6.1
			+ 1 mo.	7.39	7.41	27.4	104.9	163.0	6.1
24	23	iii	6	7.41	7.45	25.4	100.8	142.2	5.3
			8	7.40	7.42	26.1	108.0	144.5	
			+ 6 days	7.40	7.45	27.0	105.7	153.1	5.0
			+ 3 mo.	7.38	7.38	29.2	102.4	160.5	5.3
25	23	i	5	7.40	7.55	25.6	98.8	141.6	5.6
			6	7.42	7.39	25.7	100.4	148.2	5.2
			9	7.39	7.46	25.1	100.9	152.0	6.1
			+ 1½ mo.	7.38	7.29	28.2	103.0	148.0	6.8
26	17	i	3	7.35		25.5	96.6	145.4	5.8
			6	7.40	7.44	26.3	107.0	144.0	5.5
			8	7.36	7.47	22.7	106.2	146.5	6.7
			- 9½ hr.	7.39		20.2	103.5	156.5	6.6
27	31	ii	- 8 hr.	7.35	7.25	25.0	101.5	148.0	5.3
			+ 4 days	7.42	7.30	29.9	98.2	149.4	5.5
			+ 1 wk.	7.39	7.40	25.7	100.3	146.3	6.1
28	21	i	- 3 days		7.36	23.9	98.2	141.1	5.6
			+ 4 days	7.32	7.30	23.2	100.2	143.2	5.4
29	20	i	- 6 hr.		7.33	23.4	93.5	142.2	5.2
			+ 1 wk.	7.39	7.31	24.3	106.0	142.5	6.0
30	21	i	- 7½ hr.		7.41	21.3	91.8	141.5	6.2
			+ 1 wk.	7.42	7.38	27.3	104.3	145.5	6.1
31	28	ii	-10 hr.	7.37	7.36	20.9	111.2	157.0	5.0
			+ 3 days	7.37	7.42	25.1	107.4	146.5	5.5
32	23	i	- 7 hr.	7.38	7.43	23.5	112.2	144.5	4.9
			+ 4 days	7.40	7.34	27.3	106.9	157.4	4.8
			+ 1 wk.			28.6	103.8	153.5	5.6
33	15	i	- 3 days	7.40	7.43	25.5	106.7	150.2	4.8
			+ 3 days		7.36	24.3	104.9	147.8	5.5
			+ 1 wk.	7.35	7.35	27.0	98.9	146.0	7.0
34	24	iii	- 2½ hr.	7.37	7.43	23.0	106.3	145.8	6.1
			+ 3 days		7.41	24.2	105.1	146.0	5.3
			+ 1 wk.		7.41	26.4	105.5	145.3	
35	20	i	-13 hr.	7.38	7.48	22.3	104.2	152.0	6.3
			+ 4 days	7.44	7.51	25.7	106.2	157.0	6.3
			+ 1 wk.	7.42	7.49	25.8	103.9	152.0	6.5
36	19	i	-12 hr.	7.43	7.55		102.2	145.2	7.0
			+ 1 wk.	7.41	7.42	26.4	101.9	153.0	7.4
37	22	iv	5 mo.	7.40	7.38	25.0	103.6	134.5	
			8	7.39	7.44	26.9	100.0	141.4	5.4
			+ 1 wk.		7.40	26.9	102.0	155.3	6.4
			+ 1 mo.	7.37	7.40	27.6	102.2	150.9	6.7

\*Time immediately antepartum is indicated by a minus sign, and time postpartum by a plus.

TABLE III—CONT'D

CASE	AGE	PARA	MO. OF PREG.*	pH <sub>e</sub>	pH <sub>c</sub>	CO <sub>2</sub> m.Eq.	-Cl m.Eq.	BASE m.Eq.	PROTEIN m.Eq.
38	21	i	2	7.41	7.43	22.1	102.0	139.1	6.8
			5	7.37	7.36	21.1	105.6	146.7	5.5
			8		7.40	21.2	101.8		
			+ 1 wk.		7.41	24.6	100.5	151.4	5.8
			+ 1 mo.	7.38	7.31	23.7	101.0	149.1	6.1
39	28	i	- 6 hr.	7.37	7.31	23.3	104.2	152.0	6.3
			+ 3 days	7.48	7.57	27.0	105.0	154.0	6.7
			+ 1 wk.	7.43	7.44	26.5	101.0	155.0	6.7
40	26	iii	4	7.42	7.41	24.0	101.3	147.4	5.7
			8	7.37	7.42	24.9	108.7	149.5	5.4
			9	7.37	7.41	23.3	105.4	153.8	5.6
			+ 2 mo.	7.41	7.49	28.8	106.2	150.2	6.7
41	22	i	5	7.40	7.41	25.6	101.4	144.4	5.6
			9	7.39	7.38	26.3	106.5	152.5	4.6
			+ 2 days	7.40	7.43	26.1	103.8	148.5	5.8
			+ 1 mo.	7.40	7.45	26.4	103.5	147.4	
42	22	i	2	7.41	7.54	26.0	97.5	142.2	5.7
			4	7.45	7.50	26.8	100.4	151.0	6.1
			7	7.41	7.45	26.1	103.7	140.0	6.1
			+ 2 wk.	7.44	7.46	28.8	101.0	160.2	6.0
43	19	ii	5	7.31	7.36	23.5	107.7	146.7	5.4
			6½		7.36	25.2	102.7	143.9	5.8
			8½		7.43	23.5	106.7	142.8	
			+ 1 mo.		7.35	26.0	96.7	148.8	6.1
44	24	i	-17 hr.	7.45	7.54	25.2	102.7	150.0	6.1
			+ 3 days	7.44	7.43	26.9	102.4		
			+ 1 wk.	7.45		27.3	101.0		6.8
45	22	i	3	7.41	7.42	27.5	102.3	143.5	5.4
			7		7.58	27.6	101.0	150.2	5.3
			9		7.23	23.9	96.2	148.8	6.1
			+ 2 mo.		7.47	27.6	106.6	146.5	
46	24	iv	5	7.42	7.40	25.3	102.5	139.5	5.5
			7	7.38	7.39	24.5	98.5	141.9	5.4
			9	7.40	7.45	24.0	100.2	144.0	5.6
			-11 hr.		7.43	19.5	102.6	142.7	7.0
			+ 3 days	7.40	7.46	27.9	98.8	152.0	7.0
			+ 2 mo.	7.42	7.44	30.0	101.3	145.3	7.3

Cases 1 to 37 inclusive were entirely normal; 38 and 39 showed only a slight albuminuria; and 40 to 44, inclusive, only blood pressure elevations to between 150 and 160, systolic. Cases 45 and 46 were severe toxemias and are not included in the calculations.

In their recent paper Dieckmann and Wegner<sup>4</sup> state: "A study of the reports of pH in pregnancy seems to indicate that the change, if any, is toward the alkaline side. Kydd and his coworkers, . . ., stated that there is no change in pH. Myers and his coworkers, . . ., stated that the pH is definitely increased toward the alkaline side. . . . This controversy can be settled only by serial determinations of the carbon dioxide content and pH in at least twenty women who are studied at frequent intervals during pregnancy."

Although we have held the opinion that the pH was elevated in pregnancy, we have not intended to imply that this was always the case. In this connection we

stated:<sup>11</sup> "A high pH is not invariably found during pregnancy, for the apparent reason that the acid-base disturbance is compensated in many cases, but the evidence is quite conclusive that the pH is above the normal limits in a considerable number of cases."

Dieckmann and Wegner report all told 27 colorimetric pH observations. They state: "It is most unfortunate that more determinations of pH were not made in series A, because only serial observations can settle definitely the controversy as to whether the pH in pregnancy increases toward the alkaline side or shows no significant change. From repeated observations of pH since 1925, we believe that in normal pregnancy no significant changes occur, and furthermore, that it will require repeated determinations on the same patients throughout pregnancy to prove a change."

An inspection of their colorimetric pH data shows that, with the exception of one pH figure of 7.35, all their results were either 7.37 or 7.40. It is difficult to see how, even in strictly normal individuals, one would always obtain either one or the other of these two figures.

Doubtless Kydd, Oard and Peters,<sup>8</sup> as well as Dieckmann and Wegner,<sup>4</sup> will consider that our present electrometric pH observations are a vindication of their point of view that in normal pregnancy the pH of the blood remains unchanged. It is true that our observations covering the last six or seven months of pregnancy contain only a relatively small number of slightly elevated pH values (Fig. 1), but we still feel that the train of experimental data—increased volume of air respired, lowered CO<sub>2</sub> tension of the alveolar air, decreased blood bicarbonate and total base, all support the view that hyperventilation is the most important factor in the acid-base disturbance of pregnancy. This condition exists over such a long period of time that it would be only logical to expect compensation to occur, i.e., any elevation of the pH to return to normal. The fall in the blood bicarbonate in pregnancy can be due to a CO<sub>2</sub> deficit or an alkali deficit. The available experimental data support the former but not the latter view.

#### CONCLUSIONS

1. The slight changes of the acid-base balance of the blood which accompany normal pregnancy (principally a lowering of the bicarbonate and total base concentrations) become manifest before the third month of pregnancy.
2. Until a better explanation can be given, it is only logical to regard hyperventilation the most important factor in the decrease in blood bicarbonate observed throughout pregnancy.
3. The agreement between the colorimetric and electrometric pH values was not found to be as good when serum was employed as when plasma was used.

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## THE TRANSVERSELY CONTRACTED MIDPELVIS WITH PARTICULAR REFERENCE TO FORCEPS DELIVERY

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IT HAS long been known that midforceps delivery in generally contracted and in funnel pelvis is attended by a high fetal mortality. The recent literature shows that difficult midforceps deliveries are still frequently encountered, and that the resulting fetal mortality is high.<sup>1-3</sup> The modern trend to broaden the indications for cesarean section has thus far accomplished little in reducing the number of unsuccessful midforceps deliveries; and it seems that a further increase in the incidence of abdominal delivery is not likely to yield better results, unless newer knowledge is brought to bear on the problem of the selection of cases for section.

A belief that such knowledge can be derived from a research based on more accurate pelvimetry, combined with a diligent study of the normal and pathologic mechanism of labor, prompted me to undertake an investigation of the subject, and has sustained my interest in the problem during the past seven years.

In a previous communication<sup>4</sup> I submitted evidence to show that the narrow bispinous diameter is an important factor in the etiology of the persistent occipitoposterior position. The present study is an extension of the earlier work. Its main purpose is to determine the effect of a contraction in the width of the narrow pelvic plane on the course and mechanism of labor, particularly so far as midforceps delivery may be concerned.

The transverse diameter of the narrow pelvic plane has heretofore received only cursory attention. Interest has long been focused on the transverse diameter of the pelvic outlet. Recently<sup>5</sup> attention has been directed to the transverse diameter of the pelvic inlet. But it is still assumed, without positive proof, that the width of the lower midpelvis is of little or no practical importance. Thoughtful consideration, however, shows that "the course of labor is most eventful at the level of the ischial spines, particularly in occipitoposterior positions.

It is here that the cardinal movements of internal rotation and descent must occur simultaneously, while flexion must be maintained or re-established."<sup>4</sup> Furthermore, the greatest difficulties in midforceps delivery are usually encountered at this level of the pelvis, rather than at the pelvic outlet. The question of the clinical significance of the transversely contracted narrow pelvic plane deserves, therefore, more than the casual interest which it has thus far attracted.

#### METHODS AND MATERIALS

Material for the present study was obtained from 303 private cases, and from the last 3,638 deliveries at the San Joaquin General Hospital, a series of 3,941 consecutive cases; 1,290 of these were primiparas.

In the series of primiparas there were 67 midforceps deliveries, 2 versions, and 23 cesarean sections; 9 of the cesarean sections were done for disproportion in generally contracted and in funnel pelves. Among the multiparas, midforceps delivery was done in 4 cases, and version in 2 cases. Cesarean section was done in 27 cases, 3 of which were done for disproportion in justminor and in funnel pelves.

Version was done twice in the groups of generally contracted and funnel pelves, and both times after failure with forceps.

The low incidence of operative deliveries shows that a policy of conservatism was followed throughout, and that the series of cases is a truly representative one, unmodified, and uncomplicated by unnecessary artificial intervention.

The pelvic measurements in the entire series and all the operative deliveries were performed by me. Error due to the personal equation or to a misinterpretation of unfamiliar composite data was therefore entirely eliminated.

#### THE TRANSVERSE DIAMETERS OF THE NARROW PELVIC PLANE

1. *The Bispinous Diameter.*—The bispinous diameter was measured by means of an instrument devised in 1929.<sup>6</sup> The average value for this diameter in 1,120 consecutive cases of the present series was found to be 10.48 cm. Bispinous diameters of 9.5 cm. or less were classed as contracted. Pelves with a narrow bispinous diameter were subdivided into two groups: (a) those with a minor contraction (9.5 cm. to 9.0 cm.), and (b) those with a major contraction (9.0 cm. or less). This classification is rather arbitrary, but it was found to be useful for practical purposes.

There were 207 cases with a narrow bispinous diameter among the primiparas, and 427 such cases among the multiparas, a total of 634 cases, or an incidence of 16.1 per cent. In 228 cases of the entire series the contraction of the bispinous diameter was of a major degree (an incidence of 5.8 per cent); in 32 of these cases the width of this diameter was 8.5 cm. to 8.0 cm., and in 6 cases 8.0 cm. or less.

2. *The Interischial Diameter.*—The bispinous diameter represents the width of only the posterior section of the narrow pelvic plane, since the spines are situated eccentrically, approximately 1 cm. posterior to the midpoint of the pelvis. In order to obtain the true transverse diameter, it is therefore necessary to supplement the measurement of the bispinous diameter with the measurement of a diameter nearer to the center of the pelvis. The nearest approach to the diameter in question can be made by taking a measurement between the superior rami of the ischia, at points immediately anterior to the bases of the ischial spines. This new dimension of the pelvis will be designated as the "interischial diameter" (Fig. 1).

The interischial diameter can be readily measured as follows:

The bispinous diameter is first measured in the usual manner.<sup>6</sup> After the measurement of this diameter the rings are carried directly anteriorly to the bases of the ischial spines, and a reading is taken while the rings are spread as far apart as the walls of the pelvis will permit.

At the beginning of the present study the width of the interischial diameter was determined only in selected cases; in the last 384 cases, it was measured routinely. The average value for this diameter was found to be 11.15 cm., with extreme variations of 8.0 cm. to 13.0 cm. As in the case of the bispinous diameter, the degree of contraction was designated as minor if the interischial diameter measured 10.0 cm. to 9.5 cm., and major if its width was 9.5 cm. or less.

The average difference between the interischial and bispinous diameters was 0.67 cm. This difference was 0.3 cm. or less in 19.5 per cent of the cases, and 1.0 cm. or more in 16.8 per cent of the cases. These data show, as one would expect, that the interischial diameter does not differ greatly from the bispinous diameter. Its measurement is, nevertheless, highly desirable if a true picture of the capacity of the lower midpelvis is to be obtained.

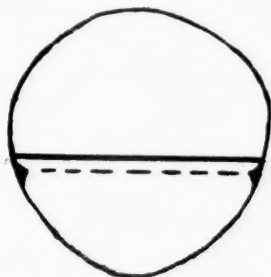


Fig. 1.—Outline of narrow pelvic plane. The upper solid line represents the interischial diameter.

In the sections to follow, reference will usually be made to the bispinous diameter for the reason that complete data are available on this diameter, and not because it is regarded as more representative than the interischial diameter. Pelves with a narrow bispinous or interischial diameter will often be referred to as pelves with a "transversely contracted narrow pelvic plane," or briefly as "transversely contracted pelves."

#### THE TRANSVERSE DIAMETER OF THE PELVIC OUTLET

The closely related transverse diameter of the outlet deserves special consideration in the present study. This diameter, commonly known as the biischial, will be referred to as the intertuberos diameter. The intertuberos diameter was measured by fitting a gauge between the ischial tuberosities, and adding 1.5 cm. to the reading obtained to compensate for the thickness of the skin and overlying fat, as recommended by DeLee. Measurements of the intertuberos diameter taken in this manner are 1.5 cm. greater than those obtained according to Williams' method. The average in the last 1,034 cases of the present series was found to be 10.87 cm. Pelves with an intertuberos diameter of 9.0 cm. or less (the equivalent of Williams' 7.5 cm.) were classed as pelves with a contracted outlet. There were 110 such cases in the entire series, an incidence of 2.8 per cent.

A close relationship was found between the intertuberos and interischial diameters. The average for these diameters, as just stated, was found to be

10.81 cm. and 11.15 cm., respectively. Unexpected differences were, however, frequently encountered. In as high as 32 per cent of the cases, the interschial diameter was narrower than the intertuberos diameter.

#### THE ANTEROPOSTERIOR DIAMETERS

In a study of the transverse diameters of the lower pelvis, it is necessary to take into consideration the anteroposterior diameters.

In the last 1,503 cases of the present series, the sacropubic or anteroposterior diameter of the narrow pelvic plane was measured by means of the internal outlet pelvimeter previously described.<sup>7</sup> These measurements showed that the length of the sacropubic diameter varies between 8.8 cm. and 14.0 cm. (average 11.10 cm. in 1,070 consecutive cases). Diameters of 9.5 cm. or less were classed as contracted. There were 22 cases in the series, an incidence of 1.5 per cent. Among these, there was only one low forceps delivery in a case of justminor pelvis. In the remaining 21 cases of this series, delivery occurred spontaneously, and without difficulty; the average birth weight was 3,489 gm. This group of cases is, of course, small, but since the findings were uniformly negative it is permissible to conclude that serious dystocia due to an uncomplicated contraction of the sacropubic diameter must be very rare. This, however, does not exclude the possibility that a contracted sacropubic diameter may be a contributory cause of dystocia in pelves in which the interschial diameter is narrow.

A plausible explanation for the above negative findings is to be seen in the fact that the sacropubic diameter is subject to considerable enlargement during delivery. In a series of 19 consecutive cases of spontaneous delivery in the usual dorsal position, it was found that the enlargement of the sacropubic diameter during delivery amounts to 0.7 cm. to 3.0 cm. (average 1.8 cm.). This enlargement occurs late in the second stage, at the time when the occiput stems under the pubic arch, and no longer recedes between pains. These measurements of the sacropubic diameter were made possible by marking the tip of the sacrum externally, so as to render its identification unmistakable during delivery.

The fact that the sacropubic diameter enlarges readily during spontaneous delivery shows that there is little to be gained from the commonly recommended exaggerated lithotomy position in cases of anteroposterior contraction of the outlet.

The posterior sagittal diameter of Klien was measured in the last 1,318 cases by means of the internal outlet pelvimeter.<sup>7</sup> The average in 1,076 consecutive cases of this series was found to be 9.58 cm.

A close parallelism was found between the sacropubic and posterior sagittal diameters. The posterior sagittal is, of course, subject to enlargement during delivery in common with the sacropubic diameter. It may, therefore, be assumed that it is of less clinical significance than the constant and unyielding intertuberos diameter. The formulas in common use in which the posterior sagittal is raised to equal importance with the intertuberos diameter may consequently be very misleading.

#### THE TRANSVERSELY CONTRACTED MIDPELVIS AND THE PERSISTENT OCCIPITOPOSTERIOR POSITION IN PRIMIPARAS

In the group of 207 primiparas in whom the bispinous diameter was narrow there were 42 cases of the persistent occipitoposterior position; while in the series of 1,082 cases in which there was no contraction in this diameter there were only 17 such cases, an incidence of the persistent posterior position of 20.9 per cent and 1.6 per cent, respectively. These data support fully the conclusion previously reached, namely, that the narrow bispinous diameter is an important factor in the etiology of the persistent posterior position, and is thus indirectly an im-

portant cause of dystocia. This finding was recently confirmed by the direct roentgenologic observations of Caldwell and his coworkers.<sup>8</sup> The association of the persistent posterior position with the transversely contracted narrow pelvic plane, and the resulting dystocia and obstructed labor, produce a clinical complex which may well be regarded as a syndrome.

#### THE TRANSVERSELY CONTRACTED MIDPELVIS AND MIDFORCEPS DELIVERY IN PRIMIPARAS

In the sections to follow, midforceps deliveries will be divided into two groups. The term "high midforceps delivery" will be applied to cases in which the lowest part of the head is 1 or 2 cm. below the level of the spines during a pain (station +1 or +2 according to DeLee's classification). Cases in which the station is +3 or +4 will be designated as "low midforceps deliveries." The term "low forceps delivery" will be restricted to cases in which the largest diameter of the head has passed the transverse diameter of the narrow pelvic plane (head on perineum or station 5).

Among the 1,290 primiparas of the present series there were, as already stated, 67 midforceps deliveries. The bispinous diameter was measured in 61 of these cases.

Among the 207 primiparas in whom the bispinous diameter was narrow there were 35 midforceps deliveries, an incidence of 16.6 per cent. In 15 of these cases the contraction of the bispinous diameter was of a major degree. Labor was complicated by the persistent posterior position, or by a transverse arrest, in 24 of the 35 cases (Tables I and II).

In the series of 1,082 primiparas in whom the bispinous diameter was not contracted there were 26 midforceps deliveries, an incidence of only 2.4 per cent. The persistent posterior position was encountered in only 8 cases of this group.

The incidence of midforceps delivery was thus 7 times greater in patients with a narrow bispinous diameter than in patients in whom there was no contraction of

TABLE I. MIDFORCEPS DELIVERY IN PELTS WITH A MINOR TRANSVERSE CONTRACTION OF THE NARROW PELVIC PLANE

CASE	INTER-TUB.	BISP.	SAC. PUB.	POSITION	STATION	WT.	RESISTANCE TO TRACTION
1	10.0	9.4		O.T.	1	4,145	Great
2	8.5	9.4		O.A.	2	4,080	Great
3	9.5	9.1	10.5	O.A.	2	4,110	Great
4	10.5	9.2	10.1	O.P.	2	3,068	Great
5	9.5	9.2		O.P.	2	4,080	Moderate
6	9.5	9.2	10.5	O.P.	2	4,695	Great
7	10.5	9.5		O.A.	4	3,360	Slight
8	10.0	9.5	9.5	O.P.	2	3,804	Moderate
9	8.5	9.5	10.0	O.P.	2	4,260	Moderate
10	10.5	9.4		O.P.	3	4,275	Slight
11	11.0	9.5		O.P.	4	4,050	Slight
12	8.5	9.2	11.5	M.A.	2	3,487	Great
13	8.5	9.3	11.5	O.P.	3	4,020	Slight
14	10.0	9.5	10.8	O.P.	3	3,720	Slight
15	10.5	9.5		O.A.	3	3,315	Slight
16	10.0	9.4	11.5	O.P.	4	4,002	Slight
17	10.5	9.2	11.2	O.P.	2	4,005	Slight
18	10.0	9.2	11.2	O.P.	3	3,990	Slight
19	10.5	9.5	11.0	O.P.	2	3,810	Slight
20	10.0	9.2	10.0	O.P.	4	4,335	Slight
21	11.0	9.1	9.5	O.P.	2	3,960	Great
Average	9.9	9.3	10.6			3,932	

this diameter. In addition to the high incidence of midforceps delivery in primiparas with a narrow bispinous diameter the difficulties in both instrumental rotation and traction were all limited to this group of cases.

TABLE II. MIDFORCEPS DELIVERY IN PELVES WITH A MAJOR TRANSVERSE CONTRACTION OF THE NARROW PELVIC PLANE

CASE	INTER-TUB.	BISP.	INTER- ISCH.	SAC. PUB.	POSITION	STA- TION	WT.	RESISTANCE TO TRACTION
1	10.0	9.0			O.P.	2	3,945	Moderate
2	10.0	8.6		9.8	O.P.	2	3,804	Great
3	9.5	8.8			O.P.	4	3,240	Slight
4	10.5	8.7		9.8	O.A.	4	4,350	Slight
5	8.5	9.0			O.A.	1	2,970	Great
6	10.0	9.0			O.P.	3	4,004	Great
7	9.0	9.0		9.3	O.A.	4	4,035	Slight
8	9.5	9.0			O.P.	4	3,540	Slight
9	9.5	8.0	8.9	9.2	O.A.	1	3,930	Great
10	9.5	8.6	9.5	9.5	O.P.	3	3,180	Great
11	8.5	8.5	9.0	10.8	O.A.	2	3,420	Great
12	10.5	9.0	9.0	10.3	O.P.	2	4,560	Great
13	10.0	8.5		11.0	O.P.	1	4,200	Great
14	9.5	9.0	9.1	11.2	O.P.	2	4,590	Great
15	9.5	9.0	10.0	11.4	O.A.	4	4,020	Slight
16	10.0	9.0		10.0	O.T.	2	4,080	Moderate
Average	9.7	8.8	9.3	10.2			3,867	

#### MINOR TRANSVERSE CONTRACTIONS AND MIDFORCEPS DELIVERY IN PRIMIPARAS

There were 21 midforceps deliveries in this group which consisted of 137 cases, an incidence of 15.3 per cent (Table I). Cases 7, 10, 11, 13, 14, 15, 16, 18, and 20 were low midforceps deliveries (Station 3 or 4). Labor was complicated by a persistent posterior position in 15 cases of this group; instrumental rotation was necessary in 5 of these (Cases 1, 4, 9, 11, and 21). Great resistance to both rotation and traction was encountered in all of these cases with the exception of Case 11. Very little obstruction to traction was, however, encountered in the 4 cases of occipitoanterior position of the series, and in the 12 cases of posterior position in which the malposition was corrected manually before the application of traction.

These data tend to show that obstruction to spontaneous and instrumental rotation is frequently encountered in cases of occipitoposterior position occurring in pelvis with even a minor degree of transverse contraction in the narrow pelvic plane. There is, however, little resistance to traction in this type of pelvis, provided there is no malposition.

#### MAJOR TRANSVERSE CONTRACTIONS AND MIDFORCEPS DELIVERY

There were 75 primiparas in this group. Among these there were 16 midforceps deliveries, and 2 elective cesarean sections, an incidence of major operative intervention of 24.0 per cent (Table II). Eight of these instrumental deliveries, namely, Cases 1, 2, 5, 9, 11, 13, and 14, were high midforceps deliveries (Station 1 or 2). In Case 11 a pubiotomy was done after failure with forceps. Among the multiparas of this group there was only 1 major operation (Case 9).

Great and even insuperable resistance to forceps traction was encountered in 9 of the 16 cases in which instrumental delivery was attempted. Great resistance



to instrumental rotation was also met in 4 of the five cases in which this maneuver was attempted (Cases 1, 6, 10, and 12).

Spontaneous delivery, however, occurred in the remaining 57 cases of this series, with an average birth weight of 3,336 gm.

The series of cases in this subgroup is too small to justify final conclusions. Tentatively it is, however, permissible to assume that a transverse contraction of the narrow pelvic plane of a major degree is a serious obstacle to high midforceps delivery, even when the complicating factor of malpositions is entirely eliminated.

#### THE TRANSVERSELY CONTRACTED MIDPELVIS AND MIDFORCEPS DELIVERY IN MULTIPARAS

Among the 427 multiparas in whom the bispinous diameter was narrow there were 4 midforceps deliveries, an incidence of only 0.94 per cent, a strikingly lower incidence than in the series of primiparas (Tables I and II).

There were 28 cases of persistent occipitoposterior position in this group. In all of these, delivery occurred spontaneously, and in the majority of them without much difficulty.

#### RELATIVE IMPORTANCE OF TRANSVERSE CONTRACTIONS AT THE NARROW PELVIC PLANE, AND AT THE PELVIC OUTLET

The intertuberos diameter is of special interest in the present study since dystocia at lower levels of the pelvis has heretofore been generally attributed to contractions of this diameter,<sup>9, 10</sup> while the transverse diameter of the narrow pelvic plane has been entirely overlooked as a possible cause of obstruction. A critical review of the subject shows, however, that the importance heretofore attached to the intertuberos diameter has been greatly overestimated. It is common knowledge that obstruction is rarely encountered in low forceps deliveries, and that the greatest resistance in midforceps deliveries, even in the so-called typical funnel pelvis, is usually met when the largest diameter of the head is at the level of the spines, and not when it is at the pelvic outlet. Furthermore, in justinor pelvis in which the bispinous diameter is narrow but in which there is a relatively slight contraction in the intertuberos diameter, the resistance to forceps traction is met at a level no higher than in funnel pelvis. Clinical experience, therefore, teaches that the transversely contracted narrow pelvic plane is the common denominator in justinor and in funnel pelvis, and that it is probably the chief cause of obstruction to instrumental rotation and traction in both of these types of pelvis.

This view is strongly supported by the following comparative clinical study of the intertuberos and bispinous diameters.

In the 634 cases of the present series in which the bispinous diameter was narrow, there were 95 cases in which there was an associated contraction of the outlet (an intertuberos diameter of 9.0 cm. or less). The average for the bispinous diameter in these cases was 8.80 cm. In this subgroup of 95 cases with a contracted outlet, there were 8 cases of obstructed labor, an incidence of 8.4 per cent. In the remaining 539 cases of the series in which the width of the outlet was within normal limits (9.5 cm. or over), there were 301 consecutive cases in which the bispinous diameter was of comparable width (average of 8.93 cm.). In this subgroup there were 23 cases of dystocia, an incidence of 7.6 per cent. The frequency of arrest of labor in these two groups is thus practically identical. It seems, therefore, that the incidence of dystocia is not appreciably increased in pelvis with a narrow bispinous diameter in which there is a coexistent contraction of the intertuberos diameter.

From these observations it follows that a contraction of the intertuberos diameter which is unassociated with a contraction in the bispinous diameter is

rarely a cause of serious dystocia, regardless of any ordinary degree of shortening in the posterior sagittal diameter. In other words, it seems that the real cause of dystocia and of obstruction to forceps delivery in pelves with a narrow intertuberos diameter is a coexistent contraction of the transverse diameter of the narrow pelvic plane, and not a contraction of the posterior sagittal diameter, as heretofore generally assumed. It may, therefore, be provisionally concluded that the transversely contracted narrow pelvic plane is a real obstacle in the cases under consideration, and is probably of far greater importance than the narrow intertuberos diameter as a cause of obstruction to forceps delivery, particularly to instrumental rotation.

#### THE INTERTUBEROUS AND INTERISCHIAL DIAMETERS AS A BASIS FOR THE CLASSIFICATION OF PELVES

Accurate measurements of the intertuberos and interischial diameters offer a basis for a simple and practical classification of transversely contracted pelves. Early in the course of the present study I gained the impression that pelves with a contracted outlet conform to the classical type of justominor rather than funnel pelvis, if the contraction of the intertuberos diameter is associated with a major contraction of the bispinous diameter. This impression has been strengthened by the results obtained from the recent measurements of the interischial diameter.

On the basis of these observations, transversely contracted pelves will be divided into three groups: "funnel pelves," "simple justominor pelves," and "flat justominor pelves." The term "funnel pelvis" will be applied to pelves with an intertuberos diameter of 9.0 cm. or less, provided that the width of the interischial diameter exceeds 10.0 cm. Pelves in which the interischial diameter measures 10.0 cm. or less will be designated as "simple justominor pelves," regardless of the width of the intertuberos diameter. Justominor pelves in which there is an associated contraction of the true conjugate will be referred to as "flat justominor pelves." The incidence of these types of pelvic contraction in the present series cannot be determined accurately, since measurements of the interischial diameter were taken only in a small number of the cases. For the present purpose, the interischial diameter may, however, be estimated by adding 0.7 cm. to the values obtained for the bispinous diameter. On this basis, the incidence of funnel and justominor pelves in the last 1,034 cases was 1.6 per cent and 5.8 per cent, respectively.

The following are good examples of the types of pelvic contraction under consideration:

*Funnel Pelves:* Cases 2, 9, 12, and 13 in Table I.

*Simple Justominor Pelves:* Cases 3, 4, 10, 11, 12, and 14 in Table II.

*Flat Justominor Pelves:* (Diagonal conjugate 11.5 cm. or less.) Cases 2, 9, and 13 in Table II.

This grouping of pelves may appear to be a step backward from the progress recently made by Caldwell and his associates in the classification of pelves.<sup>11</sup> There is, however, still a pressing need for a simple purely clinical classification of pelves which may be based on instrumental pelvimetry unaided by the x-ray. The present working classification is offered to fill this practical need.

#### COMMENT

It is a well-known fact that spontaneous uncomplicated delivery occurs in a large percentage of justominor and funnel pelves. The greatest difficulties are, however, frequently encountered in such cases

if instrumental delivery is attempted. Great resistance to instrumental rotation is frequently met in pelvis with even a minor degree of transverse contraction in the narrow pelvic plane. Serious obstruction to both rotation and traction is often encountered under circumstances where an arrest of labor is primarily due to inertia or to excessive soft tissue resistance, and not to actual disproportion. It seems, therefore, that disproportion in transversely contracted pelvis is seldom absolute or preexistent, but is usually due to the limitations of the present methods of forceps delivery, to an inefficiency of the force of instrumental rotation and traction as compared with the force of the natural powers of labor.

An analysis of the pathologic process involved leads one to suspect that deflexion is probably the abnormality in the mechanism of labor which is chiefly responsible for the obstruction to forceps delivery.

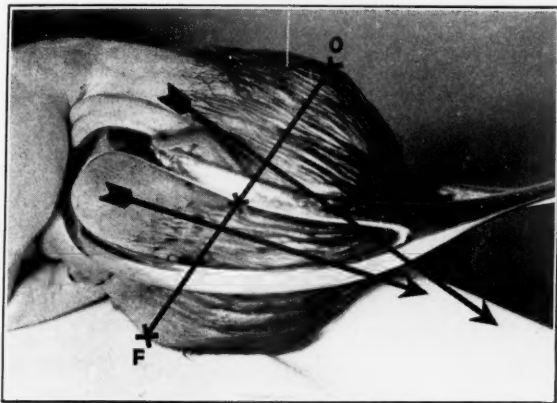


Fig. 2.—The direction of the forces of spontaneous and instrumental delivery. The upper arrow shows that the forces of natural labor are transmitted posterior to the ears, and at right angles to the occipitofrontal diameter (O.F.). The force of instrumental delivery, on the contrary, is applied chiefly anterior to the ears, and at an angle of approximately  $110^\circ$  to the occipitofrontal diameter. The result is a reversal of the occipitosincipital lever.

In spontaneous delivery this complication is of no serious consequence, since descent usually produces flexion, while flexion in turns favors descent. In instrumental delivery, however, there is a dissociation of these two cardinal movements: forceps traction causes descent but no flexion. In a recent communication<sup>12</sup> I pointed out that "this radical departure from the normal mechanism is due to the circumstance that forceps traction must necessarily be applied along the mentooccipital diameter (instead of the cervicovvertical diameter along which the powers of labor are normally directed). The two-armed lever effect is therefore inevitably lost and the force of traction is distributed equally to the two poles of the head" (Fig. 2). The attempt commonly made of securing flexion by raising the handles of the forceps before compressing them is seldom rewarded with great success. The

failure is due to the circumstance that the head is often molded and is irreducibly fixed in an attitude of deflexion.

Serious obstruction is especially likely to result in transversely contracted pelvises when labor is complicated by the occipitoposterior position, since deflexion is most marked in these cases, and is most persistent even after the malposition is corrected. Instrumental rotation under these circumstances, even with the Kielland forceps, is usually difficult and destructive; and if manual rotation fails, instrumental rotation and traction must be applied with the occiput in a position anywhere between  $135^{\circ}$  and  $45^{\circ}$ , and the enlarged anteroposterior diameter of the partially extended head must be forced through a contracted transverse diameter of the lower midpelvis. A diameter of the fetal head of 10.0 cm. or more (a dimension approaching in length that of the suboccipitofrontal diameter) is thus brought into relation with a narrow interischial diameter of 10.0 cm. or less. Poor flexion may thus be of little consequence in normal pelvises, but in pelvises with even a moderate contraction in the transverse diameter of the narrow pelvic plane, it may be a formidable complication, causing insuperable resistance to instrumental rotation, as well as great obstruction to forceps traction, even after malpositions are corrected, and after all the classical conditions for forceps are fulfilled. The disastrous results of midforceps delivery in cases of persistent posterior position are probably due not so much to the malposition per se, as to the accompanying deflexion, and the commonly associated transverse contraction of the narrow pelvic plane.

Engagement in the occipitoposterior position is therefore to be regarded as a danger signal in primiparas with a transversely contracted narrow pelvic plane, particularly so if the contraction is of a major degree. The outlook under such circumstances becomes increasingly unfavorable if rotation fails to occur as the end of the first stage of labor is approached.<sup>4</sup> Serious difficulties are to be anticipated in such cases if the posterior position still persists after complete dilatation, and especially after rupture of the membranes.

The particularly unfavorable effect of deflexion in the cases under consideration would perhaps be minimized if the occiput could be rotated directly anteriorly, so as to bring the sagittal diameter of the head in direct relation with the relatively spacious anteroposterior diameter of the lower midpelvis. If this could be accomplished, the pelvic curve of the forceps would accurately conform to the curve of the pelvic axis, which would further facilitate traction. It is, however, unphysiologic, and it is often difficult or impossible to approach the direct anterior position any nearer than  $45^{\circ}$ , while the head is still in the midplane; in many of these cases direct anterior rotation becomes possible only after the head is well down on the perineum.

Midforceps delivery in transversely contracted pelvis may also be a contributory cause of disproportion in another important respect. The fenestrated blades commonly in use are flat from rim to rim; they have a width of about 4.5 cm., and a thickness of about 0.3 cm. At the lower midpelvis, which is nearly cylindrical in form, each blade may subtend an arc the width of which, including the thickness of the blade, would amount to approximately 1.0 cm. If the pelvic walls were firm and unyielding throughout, available midpelvic space would thus be reduced by 1.0 cm. on each side (Fig. 3). The actual reduction in the width of the midplane must, however, be less than this, since the bony framework of the lower midpelvis is interrupted posteriorly by the sacrospinous ligaments, and is padded anteriorly by the obturator internus. The only exposed bony segments encircling the narrow pelvic plane are the pubic rami, the ischial spines, and the tip of the sacrum. It is therefore unlikely that all four rims of the

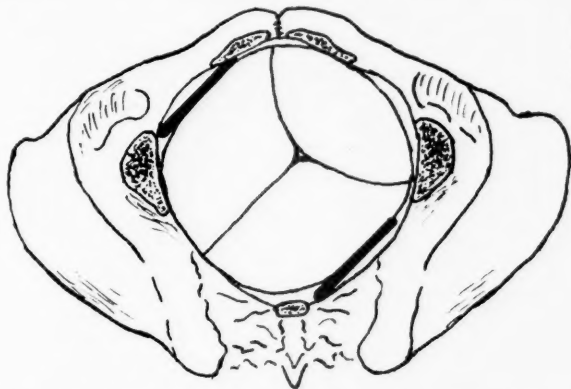


Fig. 3.—Diagram of a section at the narrow pelvic plane with a well-flexed head in position of O.L.A., and station + 4. The heavy straight lines at the sides of the head show the extent to which the forceps blades encroach on midpelvic space  $\times \frac{1}{2}$ . (Redrawn from DeLee's *Obstetrics*. W. B. Saunders Co.)

forceps blades may strike bony resistance on both sides of the pelvis at the same time. With due allowance for the buffer effect of the soft tissues, it is nevertheless highly probable that the forceps blades may encroach considerably on midpelvic space by "bridging over" the concave sides of the pelvis anterior to the spines (Fig. 3). In other words, when the presenting part is within the grasp of the forceps blades, it loses its freedom of adaptation to the hollow of the ischium which extends anteriorly above and below the level of the spines. The result is an inevitable shortening in the available width of the transverse diameter of the lower midpelvis.

#### PRACTICAL BEARING ON TREATMENT

The question of disproportion at the narrow pelvic plane is obviously a very complicated one. Factors other than spacial relations play a more important rôle here than at the pelvic inlet. Rigidity of



the soft parts, and weak or poorly coordinated uterine contractions, may be the cause of serious dystocia; and a malposition or a faulty attitude may offer insurmountable resistance to midforceps delivery, even in cases in which there is only minimal primary disproportion. Due to these variables the problem of disproportion at the narrow pelvic plane cannot be reduced to a simple formula in terms of centimeters or grams. Information gained from accurate measurements of the bispinous and interischial diameters may, nevertheless, be of great practical value.

A major contraction of the transverse diameter of the narrow pelvic plane may often be a factor of decisive importance in favor of cesarean section after a test of labor. In certain cases this degree of contraction may be an indication for elective cesarean section, as in elderly primiparas, and in multiparas in whom a previous instrumental delivery resulted disastrously. The indication for abdominal delivery may even be absolute in the rare cases of extreme contraction in which the width of the bispinous and interischial diameters falls below 7.75 cm., and 8.5 cm., respectively.

The present study has a particularly important bearing on various problems pertaining to the management of the persistent occipitoposterior position.

It is generally agreed that instrumental rotation, even with the Kielland forceps, is more difficult and more dangerous than manual rotation. The present analysis of the mechanism of labor shows that rotation by means of forceps is particularly destructive in transversely contracted pelves. In this type of pelvis especially, an earnest effort should therefore be made to rotate the head manually; and if this fails, delivery in the direct occipitoposterior position may occasionally be attempted before restoring to the hazardous procedure of instrumental rotation. Cervical cesarean section may be fully justified under these circumstances even in the presence of only a minor degree of transverse contraction, if the head is at station 2 or higher, and if difficulty in manual rotation is to be anticipated, as in cases of tetany of the uterus, or contraction ring dystocia.

The views presented have also an important bearing on the question of treatment following manual rotation. It has long been taught that labor should be allowed to proceed spontaneously following the reduction of a posterior position provided, of course, that the malposition has been overcorrected, so that there is no tendency of the occiput to return to its original position. It has also been taught that forceps traction should be applied synchronously with the uterine contractions. The present study bears out the wisdom of these teachings. In selected cases in which the uterine contractions are powerful and well coordinated, even a brief period of labor following the correction of the malposition may bring about a remodeling and a fixation of the head in



an attitude approaching normal flexion. The flexion thus secured will be least disturbed during subsequent delivery if traction is applied only during uterine contractions.

As a general rule, it may be stated that in transversely contracted pelvises the second stage of labor cannot be eliminated or curtailed without greatly increasing the difficulties and hazards of midforceps delivery. A policy of ultraconservatism is therefore clearly indicated in these cases, if delivery through the natural passages is decided upon. In the light of present knowledge "the early operative intervention" previously suggested<sup>4</sup> should be limited to manual rotation; actual delivery may well be postponed until definite indications arise for the termination of labor.

To recapitulate, it may be stated that uncomplicated spontaneous delivery may be anticipated with greater confidence, and that the problem of midforceps delivery may be faced with less apprehension in the presence of a posterior position, and even in the presence of a considerable degree of outlet contraction, provided that the bispinous and interischial diameters are within normal limits. Conversely, even a minor degree of transverse contraction in the narrow pelvic plane may render the outlook for normal delivery decidedly unfavorable, if the head remains in the posterior position at station +2 or higher, for any length of time after the rupture of the membranes.

It is clear, therefore, that accurate and properly interpreted measurements of the bispinous and interischial diameters may yield knowledge of inestimable practical value; knowledge which may enable one to avoid some of the difficulties and hazards of instrumental delivery, and which may help to reduce materially the incidence of impossible midforceps deliveries, at the expense of only a slight and pardonable increase in the incidence of cesarean section.

The foregoing practical questions, and perhaps others, may come to mind. The magnitude and the importance of the subject forbid further consideration of these at the present time. Specific and final recommendations concerning treatment must be postponed, pending more extensive clinical observation and statistical study.

#### SUMMARY AND CONCLUSIONS

The clinical significance of the transverse diameter of the narrow pelvic plane, as represented by the bispinous diameter, was studied in a series of 3,941 consecutive cases; 1,290 of these were primiparas.

The observations made may be summarized as follows:

1. The transversely contracted narrow pelvic plane is associated with the persistent occipitoposterior position in a high percentage of cases. The constancy of this association, and the resulting dystocia, constitutes a clinical complex which may be regarded as a syndrome.

2. Operative intervention is necessary in a relatively large percentage of primiparas in whom there is a transverse contraction of the lower midpelvis. In 207 such cases of the present series there were 35 midforceps deliveries, an incidence of 16.6 per cent. In 1,082 cases in which the transverse diameter was not contracted there were 26 midforceps deliveries, an incidence of only 2.4 per cent.

3. Great resistance to instrumental rotation is frequently encountered in pelves with even a minor transverse contraction of the narrow pelvic plane (a bispinous diameter of 9.5 cm. to 9.0 cm.). In pelves with this degree of contraction, resistance to traction is, however, seldom met, provided there is no malposition.

4. Insurmountable resistance to forceps traction is often encountered in pelves with a major transverse contraction of the narrow pelvic plane (a bispinous diameter of 9.0 cm. or less), even after the correction of malpositions.

5. The resistance to rotation and traction in pelves with a transversely contracted narrow pelvic plane is probably in a large measure due to a persistence of deflexion incident to forceps traction, rather than to absolute or preexistent disproportion. Another probable cause of disproportion in these cases is an encroachment of the forceps blades on midpelvic space.

6. From the observations recorded, it is tentatively concluded that high midforceps delivery is usually contraindicated in pelves in which there is a major transverse contraction of the narrow pelvic plane, and that instrumental rotation is usually contraindicated even if the transverse contraction is only of a minor degree.

7. A new dimension of the pelvis, the interischial diameter, is described; and a new practical classification of transversely contracted pelves is presented.

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## A CONTRIBUTION TO THE ETIOLOGY AND TREATMENT OF PUERPERAL INVERSION OF THE UTERUS\*

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THERE is at the present time a very considerable difference of opinion as to the factors involved in the production of puerperal inversion of the uterus. The treatment of this unusual complication of labor is not well standardized, probably chiefly because of its rarity. The commonly accepted classification of puerperal inversion as acute, or chronic, is usually considered to be dependent solely upon the time elapsing after the occurrence of the inversion; namely, puerperal inversion discovered at any time less than a month after its occurrence has been termed acute, and cases noted more than one month after their origin, chronic. This classification is in many ways unsatisfactory. It is entirely arbitrary, bearing little if any relation to the pathology of the condition or the indicated treatment. Kellogg has recently suggested what seems to be a more rational classification, namely, acute, subacute, and chronic, depending not only upon the time elapsing after the occurrence of the inversion, but upon the pathology of the condition present. Puerperal inversion may be considered acute at any time before there is definite cervical contraction. Cervical contraction is usually well established after forty-eight hours. Cases are considered subacute where there is well-established cervical contraction and the case is of less than one month's duration. After one month, Kellogg accepts the usual classification and the case is considered chronic. This classification is more rational, not only because it is partly dependent upon the pathology found but also because it bears a very definite relation to the indicated treatment.

Five cases of puerperal inversion have been noted on the Obstetrical and Gynecological Services at Bellevue Hospital since 1924; these were reported by Barrows in 1934: since this time I have noted two additional cases.

A large group of writers believe that the principal etiologic factor is trauma, exerted usually in the form of improper Credé or traction on the cord. Huntington goes so far as to state that it is wise to consider puerperal inversion as usually the result of mismanagement on

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the part of the obstetrician. It seems to me, however, that when one considers the number of parturient women attended by the unskilled, not only in the past but at present, and at the same time the extreme rarity of inversion, a necessary conclusion is that trauma and unskilled management of the third stage are only occasional etiologic factors. Küstner states that it is difficult to conceive of an inversion of the uterus being produced by pressure from above or traction on the cord if the uterus is firmly contracted. Crampton maintains that the cord will break before a firmly contracted uterus will invert. It seems necessary to have as etiologic factors not only a patent cervix but an abnormal degree of relaxation of the corpus. A true fundal



Fig. 1.—Gross photograph of section taken from the uterine fundus, showing many large organized blood sinuses.

implantation is the most unusual location for the placenta. A careful study of the literature as it relates to puerperal inversion shows that in almost every case in which the location of the placenta was noted, it was described as fundal. The rarity of fundal implantation corresponds to the infrequency of inversion. The importance of fundal implantation as an etiologic factor in inversion has been noted by many writers in the past (Bumm, Athill, McCullogh, Irving and others). The fact that inversion is more common in primigravidas may possibly be accounted for by the greater incidence of fundal implantation in the primigravida. In this series of seven cases the placental location was noted in but two instances and in both it was fundal.

## CASE REPORT

The last case in this series was seen by me at the Victory Memorial Hospital, Brooklyn, in January, 1935. In this case a complete hysterectomy, abdominal, performed eight days after the occurrence of the inversion, permitted histologic study of the uterus. Blocks of tissue were removed from several areas, the exact fundus and three separate points in the corpus, below the fundus. There was no significant histologic variation in the three points below the fundus, hence but one characteristic area will be discussed. Microscopic slides of the entire thickness of the uterus were prepared from each of these areas (Figs. 1 and 2). Fig. 1 is from the fundal block, Fig. 2 from the lateral uterine wall block. Each of these slides was divided into three extremities for microscopic study, being designated as muscularis mucosa or endometrial, mid-zone, and serosal extremity. A study of the slide from the

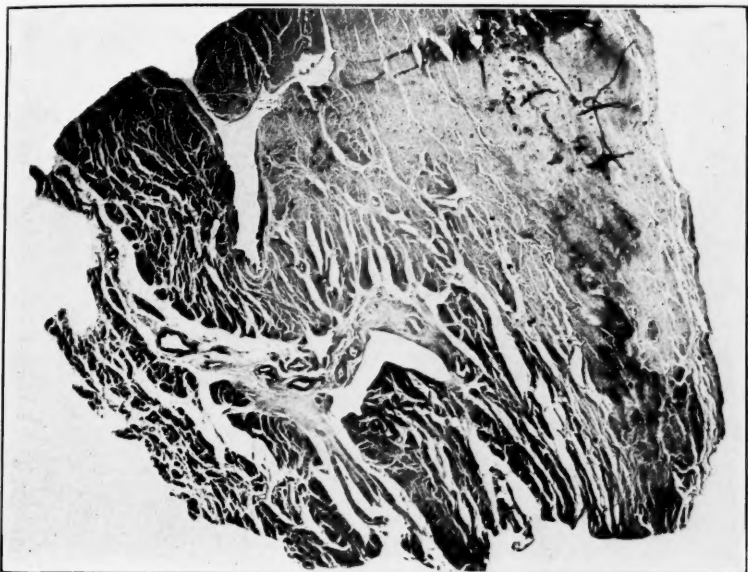


Fig. 2.—Gross photograph of section taken from the lateral uterine wall, showing lack of blood sinuses and comparatively little evidence of injury.

lateral uterine wall, muscularis mucosa or endometrial extremity. Fig. 3 shows a lack of large blood sinuses, edema of the muscle fibers but relatively little evidence of injury, no evidence of placental implantation. The lateral wall, mid-zone area, Fig. 4, shows edema of the myometrium and evidences of an inflammatory cell infiltration. The lateral wall, serosal extremity, Fig. 5, shows relatively little damage to the myometrium. There is some edema of the muscle fibers; the fibers are, however, intact. In contrast with this the microscopic findings in the section from the fundus are as follows: Fig. 6, from the mucosal area, shows many large blood sinuses undergoing organization, evidence of placental implantation. There is also marked edema of many muscle fibers. Fig. 7, from the mid-zone area, shows a large blood sinus extending to the myometrium, with organization of the sinus and destruction of the myometrium. Fig. 8 from the serosal extremity in the fundus shows edema with disintegration of the muscle fibers and an acute inflammatory cell infiltration. Fig. 9, a high power photomicrograph of the same section as Fig. 8, shows edema, polymorphonuclear invasion, with loss of nuclei in the muscle cells, and evidence of beginning necrosis.



Thus it is shown histologically that not only was the attachment of the placenta at the fundus in this case, but also that this attachment produced a definite destructive action upon the myometrium of the

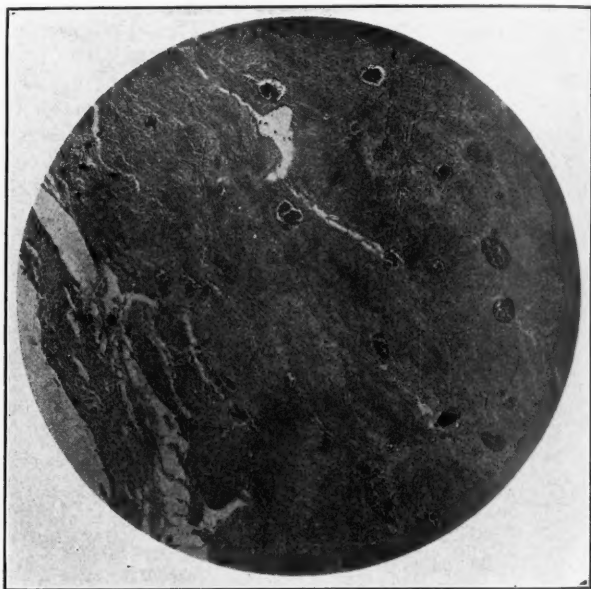


Fig. 3.—Photomicrograph of lateral uterine wall, muscularis-mucosa, showing a lack of large blood sinuses, edema of the muscle fibers but relatively little evidence of injury, no evidence of placental implantation.

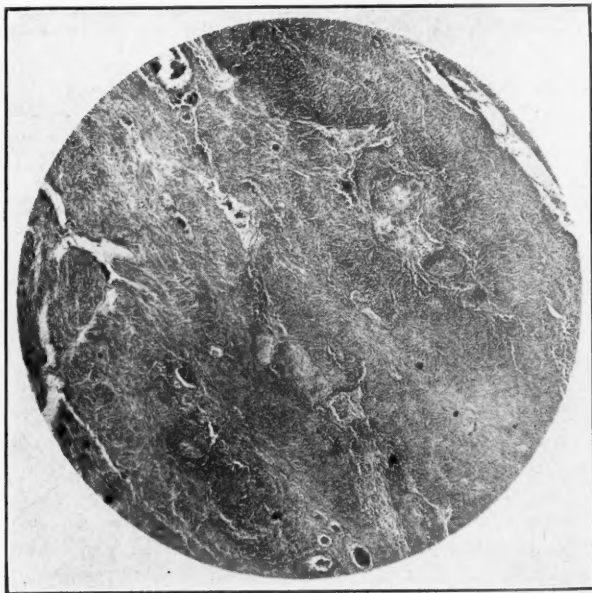


Fig. 4.—Photomicrograph of lateral uterine wall, mid-zone area, showing edema of myometrium, acute inflammatory cell infiltration.



fundus, thereby setting the stage, so to speak, for inversion. Observations at cesarean sections have shown that the placenta remains adherent to the uterus during the first few moments of retraction of the

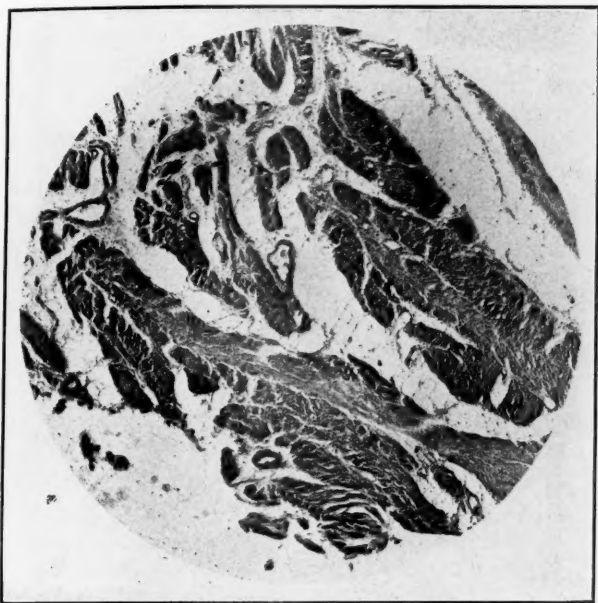


Fig. 5.—Photomicrograph of lateral uterine wall, serosal extremity, showing but little damage to the myometrium. There is some edema of the muscle fibers; the fibers are, however, intact.

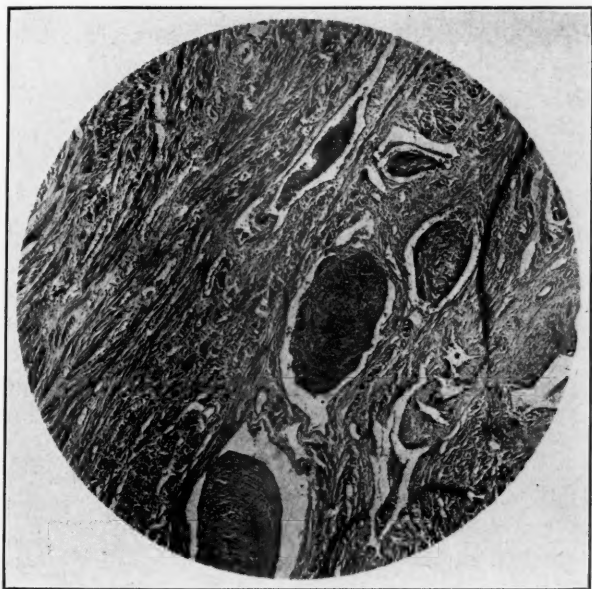


Fig. 6.—Photomicrograph of fundus uteri, muscularis-mucosa, showing large blood sinuses undergoing organization, evidence of placental implantation, edema of many muscle fibers.

myometrium. The uterine wall is thick everywhere except at the placental site. When the placental attachment is at the exact fundus we have, therefore, the mechanical factor of placental weight, the thin-

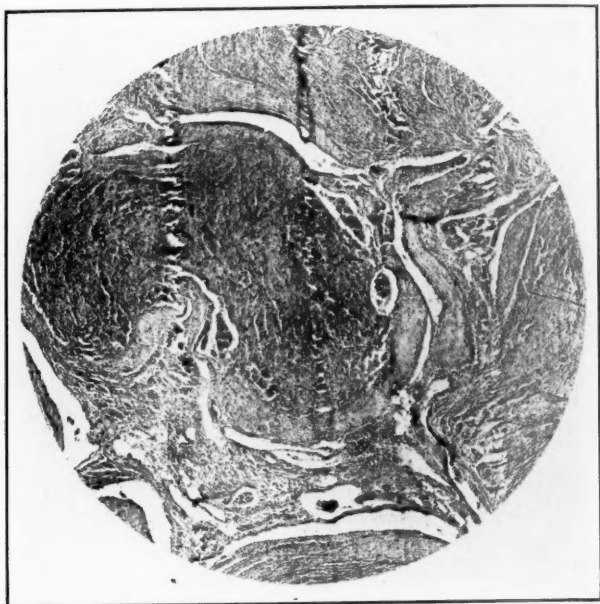


Fig. 7.—Photomicrograph of fundus uteri, mid-zone area, showing a large blood sinus extending to the myometrium with organization of the sinus and destruction of the myometrium.

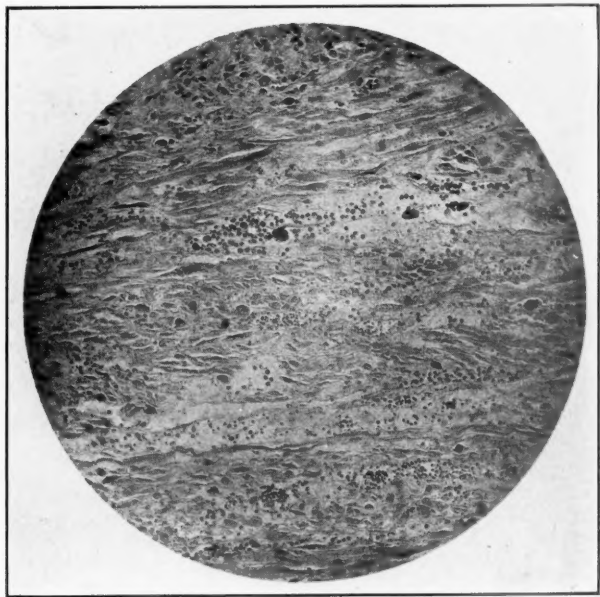


Fig. 8.—Photomicrograph of fundus uteri, serosal extremity, showing edema, disintegration of the muscle fibers and acute inflammatory cell infiltration.

ning of the myometrium at the placental site and the destructive effects of placentation, all exerting a definite influence in favor of inversion. Trauma either by traction from below or unskilled pressure from above may in some instances be a contributing factor but as capably stated by Reeve, "the accident may occur independent of anything done or omitted." Once a partial or incomplete inversion is produced the uterus may force the fundus out from above as it would a foreign body.

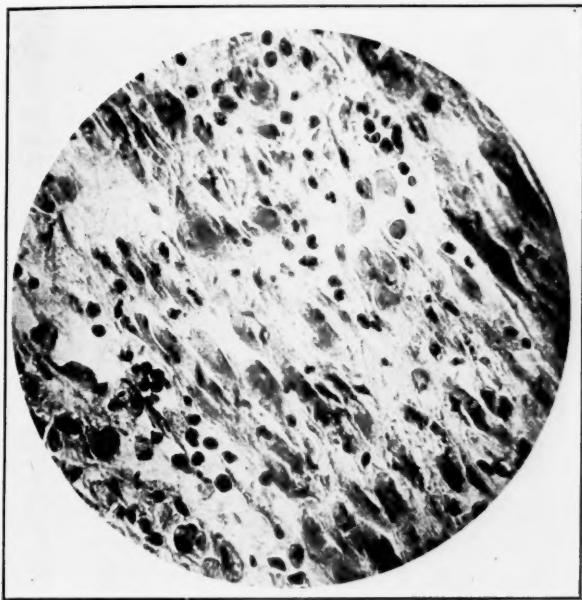


Fig. 9.—Same section as in Fig. 8. High power photomicrograph showing edema, polymorphonuclear invasion, loss of nuclei in muscle cells, evidence of beginning necrosis.

#### SUMMARY

The treatment of the seven cases comprising this series may be summarized as follows: There was one acute case, not in shock; this inversion was easily and successfully reduced by immediate manual reposition from below. There was one subacute case; the patient was operated upon successfully when ten days postpartum, after the technic of Spinelli. This patient died, following an easy labor, two years after her Spinelli operation. The cause of her death was rupture of the uterus, the rupture taking place through the scar of the Spinelli operation. There were five chronic cases. One reduced itself completely and spontaneously while the patient was in the hospital awaiting operation. In one a successful Spinelli operation was performed. Three of the patients with chronic cases were operated upon abdominally.

In one instance reduction was easily accomplished by manipulation alone. In a second laparotomy, the posterior uterine wall was incised in the manner suggested by Haultain. In the third laparotomy, a complete hysterectomy was done because of definite evidence of sepsis. There was no mortality in this series except in the one subacute case where death occurred two years after the Spinelli operation. This case illustrates a valid objection to the Spinelli operation in women of a child-bearing age.

Histologic evidence of fundal implantation of the placenta was found in a case of puerperal inversion, and its damaging influence upon the myometrium, in my belief, is an etiologic factor in inversion.

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## A CONSIDERATION OF SOME OF THE ASPECTS OF STERILITY\*

AN EVALUATION AFTER TEN YEARS

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TEN years ago I had the privilege of addressing this society on the same subject as tonight.<sup>1</sup> Now, as then, I can but touch upon a few points of the huge field of disturbed human fertility. I shall not discuss mechanical factors, as they are fairly well known today. I will stress mainly those points which to me appear to represent an advancement of our knowledge of the subject. In the past ten years some factors have become more important, others less so. Thus, the so-called obscure causes of sterility which I discussed in detail before, play less of a rôle today. "Relative sterility," or as I chose to call it, because it more nearly expresses actual conditions, "selective fertility," is no longer a mystery. Sperma immunity, differing blood groups in the two sex partners, psychic causes, have all been evaluated and found wanting. Vaginal acidity has been assayed and is not an adequate cause for otherwise unexplained sterility, especially since I was able to show that the introduction of the alkaline mucus from the Bartholinian glands on the male organ during coitus almost neutralizes any acidity present. The rôle of the cervix is also well understood today; it is a mechanical and not a chemical rôle. Blood and pus and bacteria have no effect on the sperms and I cannot corroborate the reports of Rosenthal<sup>2</sup> that *Bacillus coli* causes sperm agglutination. The varying solubility of cervical mucus in semen reported by Kurzrock and

\*Presented at a meeting of the New York Obstetrical Society, March 10, 1936.

Miller<sup>3</sup> I have shown<sup>4</sup> to be dependent entirely on the stage of the menstrual cycle. With finer technic perhaps another test for the time of ovulation can be developed here. Varying uterine muscle irritability is likewise dependent on the stage of the menstrual cycle.

We thus arrive once again at what I stressed ten years ago, the importance of germ plasm defects, and I feel that it is along these lines that further advances of our knowledge must come. We must think beyond mechanical and simple chemical disturbances.

Seven years ago I had the temerity to propose an hypothesis based on local excessive ovarian hormone activity for the occurrence of adenomyosis and uterine fibromyomas.<sup>5</sup> Since then Witherspoon and Butler,<sup>6,7</sup> Dean Lewis and Geschickter,<sup>8</sup> have published similar theories. They gain support from the report of Papanicolaou that the epithelium of the endometrium is derived directly from the stroma and that endometrial epithelium, stroma, and uterine wall are all mesoderm. The relation of breast pathology to endocrine states is a further point of support. The objections voiced against this possible etiology of uterine fibromyomas so far seem to me not to be conclusive for reasons I cannot go into now. Furthermore, I do not bring up this subject in a controversial manner. I simply want to show that the very fact that such a theory can arise shows that we are getting away from the purely mechanistic way of thinking. Because carrying out the idea further leads to the inevitable sequential reasoning that abortions in cases of fibromyoma may be not simply mechanical but perhaps endocrine, and the same is true of abortions occurring in women with hypoplastic uteri. It has been said that succeeding pregnancies developed the uterus. Is it not more logical to go back to underlying principles and say sexual activity has stimulated the ovary or pituitary, or both, and thus the uterus gradually developed, while more important still, the ovary is enabled to produce normal ova? For only a normal ovum and a normal sperm can ever produce a normal zygote. Defects in either one of the two germ cells inevitably lead not only to sterility, but in the lesser degrees, to abortion, premature labors, stillbirths, and fetal anomalies. This should have been clear years ago. On the very surface it is evident that we have here an equally divided responsibility, but the difficulty of research in human beings and the incorrect dictum that it takes only one sperm to fertilize an ovum has probably led Cary,<sup>9</sup> myself and others, who were near the truth years ago, astray. In addition, our superior male ego preferred to cast the blame on the woman and thus prevented us from seeing light and really understanding what is meant by the old adage "It takes two to make a baby." Thus today we talk less of the sterile man or woman, and more of the sterile couple, and examine both man and wife care-



fully and try to evaluate the combined factors found. Every investigation, of course, should begin with a careful anamnesis. This should determine, for reasons mentioned in previous papers, whether or not the man and wife were full-term babies. The time of puberty must be especially carefully evaluated, and the relation of the vitamins to the endocrines (Vogt,<sup>10, 11</sup> Vogt-Møller,<sup>12</sup> Vogt-Møller and Bay<sup>13</sup> and others) thought of. Menstruation, of course, is to be most carefully investigated. Even though we still do not know the actual reason for the menstrual bleeding, we do know that it is the waning of the corpus luteum and not the death of the ovum that causes the breaking up of the premenstrual endometrium. It is practically certain today that the ovum lives less than twenty-four hours, and can be fertilized for a still shorter time, partly perhaps because the ovum is an incomplete cell which contains only half the normal number of chromosomes, and partly because the ovum seems to acquire an albuminous envelope in the tube which makes sperm penetration impossible. The actual mechanism of the fertilization of the ovum today is known to be based very probably on differing electric charges, and the mystery of the prevention of polyspermism resolves itself into a neutralization of a difference of electrical potential. That the attraction of the ovum for the sperm is, however, not absolutely specific is shown by the penetration of a sperm head into a lymphocyte which I could observe under the microscope. Thereafter this lymphocyte had no more attraction for the other sperms. Another factor which must be considered is the today definitely established occurrence of anovulatory cyclic bleeding. It is interesting in this connection that Liegner<sup>14</sup> has found that hypofunction of the pancreas causes atresia of the ovarian follicles and prevents corpus luteum formation. He has cured some cases of sterility in slender, underweight, nondiabetic women who ate well and sometimes had slight menstrual disturbances, by giving insulin. Some patients with amenorrhea have responded to the same treatment. I believe we can in some patients recognize two different types of bleeding clinically. One month breast changes will be prominent, dysmenorrhea practically absent, and the bleeding starts at the regular time in the usual way without further disturbance. A month or several months later, however, breast signs are practically absent, severe uterine cramps occur, and last for days before menstruation finally becomes established. At times slight bleeding for several days precedes the actual onset of the flow. In one such patient of mine endometrial biopsies showed a typical secretory endometrium in the first instance, and only a proliferative phase in the second type of bleeding.

As far as the absolute regularity of the menstrual cycle is concerned, it is, I believe, nonexistent. Many women think they really



are regular until the dates of the onset of menstrual bleeding are actually set down for six, or better, twelve months. Then variations of at least two to three days, and not infrequently of four to five days, will be seen. According to Knaus<sup>15</sup> the onset of bleeding occurs fifteen days after ovulation. This seems a little too definite to me. We know that the size of the corpus luteum may vary, and thus it is perfectly logical to assume that its activity may last a day more or a day less at different times. In principle, however, I agree fully with Knaus. Finally it must be considered absolutely logical to assume that some ova produced even by a normal woman may be abnormal.

As far as the physical examination of the couple is concerned, I only want to stress here again that the size of the testis, unless atrophic, is no indicator of the fertility of the individual. Soft gonads, however, mean disturbed spermatogenesis, but unfortunately the converse is not true.

It is regrettable that there is no way of determining germ plasm defects in the female except by indirect methods. In the male we are more fortunate, and I feel that the detailed semen examination described by me ten years ago has done much to explain many otherwise obscure cases of sterility and definitely proved the rôle of the male in abortions, stillbirths, and fetal anomalies. I feel that the evaluation of seminal cytology (and the biometrical studies must not be neglected) will become increasingly important as more physicians make use of the method. At any rate, this detailed semen examination has done away with the totally erroneous conception that fertilizing power and motility of the spermatozoa are synonymous. Fertilizing power is undoubtedly lost long before motility ceases, and sperms which never were normal and evidently are totally incapable of fertilizing an ovum may be very actively motile. Nevertheless, motility of the sperms in animals with internal fertilization of the ovum is a *sine qua non* of pregnancy, and the evaluation of motility in any semen specimen is an extremely difficult problem. If the motility in a specimen is good we know where we stand, but if it is not good, we must be extremely careful in making a diagnosis. I have had specimens from normally fertile men where all the sperms were dead after only five minutes in a condom. Again in a normally fertile couple I have taken semen from the vault of the vagina and cervix one hour after intercourse and found practically only dead sperms. I have examined a semen specimen forty-five minutes old in which the first drop showed no motile sperms, whereas all the other drops examined thereafter showed perfectly normal conditions. The evaluation of sperm motility to me represents a great problem. There are here so many imponderables that constant vigilance is necessary to avoid serious misinterpretations.

As far as the, at one time so much talked of, sniffing sperm cell is concerned, we know today that it is nothing more than a temporarily or permanently slowed down cell, and we also know that the sperm head does not expand and contract, although this illusion may be produced by optic refraction.

As far as the number of the sperms is concerned, moderate oligospermia is compatible with normal fertility. One must, however, distinguish between oligospermia with a normal morphology and one with an abnormal seminal picture. A disregard of this fact makes most of the reports in the literature on oligospermia valueless.

As about motility I must also say a word of warning about the detailed semen examination described by me ten years ago. Even the most detailed examination will fail unless we are in a position to weigh every particle of evidence presented, and for the same reason, experience is necessary to evaluate properly seminal cytology and biometrics.

I continually get requests for my technic, because some one wants to try out the method on some case, or some physician wants his nurse or secretary to carry out the examinations. These same men would never dream of diagnosing a cervical biopsy, or intrusting this to their nurse or secretary, yet they fail utterly to realize that the evaluation of the seminal picture is just as much a question of morphology as diagnosing an early carcinoma of the cervix. Many times the treatment, even a laparotomy of the wife, depends on the result of the semen examination. In fact, unless the investigator is a trained pathologist, he will not be able to utilize to its fullest extent the seminal morphology and biometrics presented by each case. And it is significant that the only man who asked me "How long will it take me to learn what I am looking at?" was a pathologist. It is true, in general, that certain percentages of abnormal sperm heads can be used to predicate disturbed fertility and still higher ones sterility. At the same time a simple mechanical summation of the findings is not sufficient. The years have shown me that the percentages I set up some years ago<sup>16-18</sup> roughly hold good; that is, patients with less than 20 per cent abnormal sperm heads and a coefficient of variability of less than 11 may be considered normal. With a sperm count showing 20 to 25 per cent of abnormal heads and a coefficient of variability around 11.5, disturbed spermatogenesis is to be assumed. Above that clinical sterility usually prevails. However, in human beings, where intercourse is repeated again and again, it stands to reason that even couples with a relatively low degree of fertility may finally achieve offspring.

However, as I said before, these are but the general facts; counts even below 20 per cent abnormal sperm heads may denote sterility, if

narrow and tapering heads or sickle-shaped heads are marked and total 8 to 10 per cent or more. Again, a rather high total count, but with many round heads, is better than the total head count would imply, since my experience over the years has shown that round sperm heads are not very important. Also two head counts with exactly the same total number of abnormal sperm heads and even the same percentages of each type of sperm head abnormality are not necessarily to be regarded as identical. Tapering and narrow and sickle-shaped heads are perhaps the most sinister types of sperm head changes, yet in one specimen the cells, though tapering and narrow, may be much less so than in another where very long and very narrow heads are seen, which indicates a much more intense spermatogenic disturbance. In the same way a slightly narrow sperm head in a specimen in which most of the heads are well rounded is to be evaluated differently than the same type of sperm head in a specimen with less rounded sperm heads. The same of course applies to small and large heads. Thus a semen may show decided improvement, even though the total abnormal sperm count remains the same.

I am often asked if double sperm forms have any connection with twin births. This is to be denied absolutely. Double sperm forms are abnormal sperms, but even if they were normal, remembering thygmataxis, it would be impossible to visualize how such a double sperm form would penetrate the ovum with both its heads.

Although the results of my semen investigations have been confirmed by most authors, some objections have been voiced. It was claimed that the seminal morphology was subject to change. Since the constancy of the seminal picture is the first requisite for the value of this type of examination, this point naturally was originally investigated by me. I can say definitely that the seminal picture will change with increasing age or disease, but will not change suddenly without easily traceable, adequate cause. Otherwise occurring sudden morphologic changes are due either to mistakes or deliberate deception. My staining technic was also objected to, and it was claimed that cell abnormalities were artificially produced by it. Naturally this possibility occurred to me from the very first and was thoroughly tested out by me and rechecked since then. In no case did the count or the biometrics show changes beyond the probability of error. I can say further that I have yet to see stained seminal smears which can compare in clearness and detail with my properly prepared slides. One must, however, avoid errors of technic.

Another objection which was made was that the sperm counts did not allow judging of the fertility. Here, however, the evaluation was often based on those couples with children and those without children. That this is not a proper classification has been pointed out before by

mè in discussing the breeding record. Again if one counts all minor variations of the sperm heads which should still be regarded as normal one can easily obtain entirely erroneous results.

Finally it was objected that a difference of 5 per cent or more of abnormal sperm heads should make no difference. However, 5 of 20 (normal limit) is 25 per cent, and 25 per cent variation in thyroid function, for example, may in itself alone produce sterility. Aside from this, as pointed out before, the abnormal sperm heads are but an indication of the degree of spermatogenic disturbance, and mean, if of sufficient intensity, that all the other cells would be incapable of fertilizing the ovum, even though they looked normal.

Aside from morphologic and biometric facts regarding the spermatozoa, the ten years that have passed have also increased our knowledge of spermatogenesis. We know today that the seminal vesicles are not the reservoirs for the spermatozoa, but their graveyard, and that the sperms produced in the testis and endowed with some motility move on to the tail of the epididymis, maturing as they go. In the tail of the epididymis the sperms are stored, kept immotile by lack of oxygen and inhibiting secretions of the epithelium of that region. We have learned that the scrotum has a definite temperature-regulating function, and that its temperature in man is  $2.7^{\circ}$  to  $7.8^{\circ}$  C. below body temperature. I wish I had time to go into these interesting questions in detail, but I can only give you the conclusions drawn from the reports of many authors and from my own work, and that is that normal body temperature kills all sperms in a short time. At the very most they do not live longer than forty-eight hours, and personally I have found that they die in twenty-four hours. However, this is only judged by motility and this, as previously stated, has nothing to do with fertilizing power.

If now we gather up the threads spun so far we find that the human female has no definite estrus, ovulates but once a month, produces an ovum which lives at most a day, and kills off the spermatozoa in her genital tract in forty-eight hours or less. We thus come to the inevitable conclusion that conception in a woman is possible for only a few days of the whole menstrual cycle and that pregnancy is much more of a hit and miss affair than in many animals, especially those with a definite estrus. There is a vast amount of evidence today to support such a conclusion. I myself have now observed four normally fertile, carefully examined, couples from nine to three years who used no contraceptives at first during the week before menstruation, and for several years now for the periods from the end of menstruation to within four days of the calculated time of ovulation and for the last twelve days preceding menstruation. The net result of over 1,200 performed sexual acts during these periods of the men-

strual interval was one extremely doubtful abortion. This woman passed some rather large clots. There was no other evidence of pregnancy. The work of Knaus<sup>15</sup> and Ogino<sup>19, 20</sup> is even more conclusive, and Hartman's<sup>21</sup> investigations on monkeys carry additional weight.

It is true that there have been objections voiced to such periodic fertility in the human female. It is claimed by some that a woman may conceive at any time of the menstrual cycle and the finding of living sperm in the female genital tract has been reported fourteen, twenty, and even forty days after the last alleged intercourse. However, the only fact these authors proved so far is their own childlike faith in the statements of unconscious or vicious prevaricators. The memory for exact dates is always notoriously and thoroughly inaccurate, so that only written data that really seem to have been made at the time stated should be accepted.

Considering then the practically physiologic barriers to conception in the human female and our imperfect knowledge of the ductless glands, it is small wonder that many disturbances of fertility, based as they may be, on congenital or acquired defects or imbalances, should be far beyond our humble powers of analysis and therapy.

This being a gynecological society it hardly behooves me to discuss here the therapy of the female. May I be permitted, however, to say a few words about the treatment of the male with spermatogenetic disturbance? May I stress again the close relation of general physical health to fertility and the importance of a feasible reduction in the frequency of sexual congress? I want to add also that all forms of therapy begin by having a basal metabolism determination (and the same applies to my women patients). It seems significant to me that practically every single man with disturbed spermatogenesis has had a basal metabolism at least somewhat below normal. I feel that even slightly lowered thyroid function should be corrected, and have the impression that the amount of good which can be accomplished by thyroid therapy is not expressed entirely by the figure obtained by the basal metabolism test.

Aside from the thyroid, other endocrine therapy has been disappointing in many hands. The anterior pituitary-like hormone from the urine is a luteinizing hormone, and though it affects the interstitial testicular cells, as I have proved to my own satisfaction, it has no action on spermatogenesis, despite numerous reports in the literature to the contrary. Attempts to achieve pituitary stimulation with small doses of x-rays have also proved disappointing in the few cases on which I tried it.

Through the courtesy of Parke Davis and Co., I now have a gonadotropic hormone made directly from the anterior pituitary which has



shown very promising results in some cases. I have, however, at present not enough experience to go beyond this statement. Vitamin E, which seems necessary to growing cells, and thus would be necessary in the male in whom the spermatozoa are constantly being produced, and in the pregnant woman, less so in the nonpregnant female, I also use and apparently with good results. In another ten years perhaps we may know something about the therapy indicated in each case. Under all circumstances, however, the chief requisite is individualization. I feel that too much one-sided concentration on the endocrines, the vitamins, x-ray stimulation, obliteration of mechanical effects, and too great efforts to achieve pregnancy in a childless couple under any conditions have prevented us from perceiving the main problem, which is not how can we get a childless woman to conceive, but how must we treat a clinically sterile couple so that they can have a *normal* child? Before any form of therapy is instituted let us know, as far as this is humanly possible, that germ plasm abnormalities do not exist. Let us at least, in the simple way I have described, make sure of the male. Ten years ago I asked the question whether it were even worth while in many cases to try to save products of gestation that nature was trying to get rid of. In the last ten years my own experience has given me the categorical answer that it is not. It may perhaps shock some of you here tonight when I say that unless both parents have been carefully examined, I make no special efforts to try to save these very often abnormal products of gestation. Only when I know, as far as this is possible, that the husband is normal do I essay special therapy in the wife. Perhaps some products of gestation which might be saved by strenuous efforts are lost in this way, but the disappointment of a pregnancy ending in abortion is as nothing compared to the agony of the parents whose fondest hopes for a healthy and happy baby have been blasted by the birth of some misbegotten human caricature whose very being often turns love to dust and ashes, and whose continued existence is a constant source of anguish, compared to which the purely physical torture of a Tantalus is but a childish prank.

As physicians it is our duty to alleviate suffering. Let us not through thoughtlessness or neglect increase it. Let us get away from looking at infertility as a purely mechanical or chemical problem; let us concentrate our efforts on trying to determine the quality of the germ plasm of both sex partners. As our knowledge increases we will be able to do more and more in such cases of germ plasm abnormalities, and inevitably stages of improvement will thus be reached where conception is possible, but not yet the production of a normal child. As leaders of your profession, it is up to you then not to try under all circumstances to have a woman conceive, but even to prevent the



possibility of pregnancy unless you feel that normal offspring are at least probable. Unfortunately we will never be able to prevent all abnormalities, but with our imperfect knowledge, such as it is, let us do the best we can.

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30 EAST FIFTY-EIGHTH STREET

## A STATISTICAL SURVEY OF ECLAMPSIA\*

BASED ON SIX YEARS' EXPERIENCE IN PHILADELPHIA LYING-IN HOSPITAL

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THIS paper presents no new theories of etiology or treatment of eclampsia, and no new recommendations, but consists entirely of a statistical summary of our experience with this condition at the Philadelphia Lying-In Hospital from July 1, 1929 to July 1, 1935. The survey includes 12,601 patients, 38.1 per cent of whom were primigravidas and 61.9 per cent multiparas. There were 43 eclamptic patients in this group, of which 40 were ward and 3 were private patients. The inci-

TABLE I. TOTAL INCIDENCE

	RATIO	PER CENT
Our Series	1 in 293.0	0.34
Collected (Stander)	1 in 253.7	0.39

dence of eclampsia was 1 in 293 or 0.34 per cent. Hinselmann concluded from a study of statistics published up to 1924 that eclampsia occurs once in every 253.7 women entering a lying-in hospital (0.39 per cent). Thus the incidence in our series does not differ greatly from that in lying-in hospitals the world over.

\*Read before the Obstetrical Society of Philadelphia, March 5, 1936.

## INCIDENCE IN REFERENCE TO SEASON

As early as 1825 Smellie attributed a certain influence to atmospheric conditions; Olshausen, in 1890, stated that eclampsia varies with the seasons; Croom, from a study of the material of the Edinburgh Maternity Hospital, concluded that a sudden alteration in the temperature and rainfall, irrespective of any particular season, favors the development of eclampsia. Harrar found that the highest fre-

TABLE II. INCIDENCE RE SEASON

SPRING	SUMMER	AUTUMN	WINTER
21%	21%	35%	23%

quency was during the month of April, and that unsettled, damp, and cold weather is accompanied by an increased incidence of eclampsia. In our series there is no striking seasonal variation: 21 per cent occurred in the spring; 21 per cent in the summer; 35 per cent in the fall; and 23 per cent in the winter.

## INCIDENCE IN REFERENCE TO PARITY

As early as 1768, Denman observed that primigravidas were more frequently affected than multiparas. Statistical studies indicate that eclampsia occurs about 8 times more frequently among primigravidas. In our series there were 31 eclampsias among 4,802 primigravidas (1 in 155 or 0.645 per cent), while in 7,799 multiparas only 12 patients developed eclampsia (1 in 650 or 0.154 per cent). Thus, in our group eclampsia occurred approximately 4 times as frequently among primigravidous

TABLE III. INCIDENCE RE PARITY

	TOTAL NUMBER	NUMBER OF ECLAMPTICS	PER CENT ECLAMPTICS
Primigravidas	4,802	31 (1 in 155)	0.645
Multiparas	7,799	12 (1 in 650)	0.154

patients. The 7 per cent incidence of twin pregnancies is in accord with numerous previous observations.

## INCIDENCE WITH REFERENCE TO AGE

The youngest patient in this series was fifteen and the oldest was forty-three. The distribution by decades was as follows: second decade, 39.5 per cent; third, 41.9 per cent; fourth, 9.3 per cent; and fifth, 9.3 per cent. More than four-fifths of the patients were under the age of thirty years.

## TIME IN PREGNANCY

The average duration of pregnancy at which eclampsia developed was 36.4 weeks. The earliest case was at the twenty-eighth week and the latest occurred in a patient who, according to her own statement, was four weeks past term.

## INCIDENCE IN REFERENCE TO LABOR

Eclampsia occurred before the onset of labor in 65 per cent of our cases, during labor in 9 per cent, and after labor in 25 per cent. These figures are somewhat at variance with collected statistics in which the incidence is as follows: antepartum, 26 per cent; intrapartum, 53 per cent; and postpartum, 21 per cent.

TABLE IV. INCIDENCE RE LABOR

	ANTEPARTUM PER CENT	INTRAPARTUM PER CENT	POSTPARTUM PER CENT
Our Series	65	9	25
Collected (Stander)	26	53	21

## INFLUENCE OF PRENATAL CARE

The eclamptic patients have been divided into three groups according to the prenatal care which each received. We considered as having had adequate care those patients who registered in the clinic prior to the fifth month and who kept their appointments regularly. The inadequate care group is composed of those who registered late in pregnancy or were irregular in their attendance. By these standards the groups are as follows: adequate care, 40 per cent; inadequate, 37 per cent; and no prenatal care, 23 per cent. In other words, three-fifths of the eclamptic patients had either inadequate or no prenatal care.

TABLE V. INCIDENCE RE PRENATAL CARE

Adequate	40%
Inadequate	37%
None	23%
	} 60%

## TREATMENT

The modified Stroganoff or "middle line" plan of treatment has been utilized in this group of patients. We are convinced that early accouchement forcé has no rightful place in the treatment of eclampsia, and on the other hand, we feel that ultraconservative measures should be abandoned if no improvement has followed their use for a period of twenty-four hours.

TABLE VI. ONSET OF LABOR

Spontaneous	62.5%
Medically induced	5.0%
Surgically induced	7.5%
Cesarean section	25.0%
NOTE: 3 patients died undelivered and not in labor	

Sedation has been maintained by the generous use of morphine, fortified by the barbiturates, chloral hydrate, and bromides. Elimination was routinely obtained by gastric lavage followed by magnesium sulphate through the stomach tube, by high colonic irrigations, and intravenous injections of hypertonic glucose solution. Intravenous magnesium sulphate solution (20 c.c. of 10 per cent) was used in approximately half of the group. Hot packs, venesection, and spinal tap were but rarely utilized.

This line of treatment was followed from twelve to twenty-four hours in every case. If the patient improved, expectant therapy was continued. If no improvement was noted, or if the patient grew worse, active means of terminating the pregnancy were undertaken. If the patient was in labor, she was delivered as soon as feasible by forceps or podalic version. If not in labor, the primigravidas were, as a rule, delivered by cesarean section under local anesthesia, and labor was induced either surgically or by rupture of the membranes in the multiparous group.

TABLE VII. METHOD OF DELIVERY

Spontaneous	25.5%
Forceps	40.0%
Version	9.0%
Breech extraction	2.3%
Cesarean section	23.2%
NOTE: Disparity in cesarean section incidence attributable to 3 sets of twins.	

In this series, labor began spontaneously in 62.5 per cent, was medically induced in 5.0 per cent, surgically induced in 7.5 per cent, and cesarean section was performed in 25 per cent. Three patients died undelivered, three, six, and ten hours, respectively, after admission.

#### MORTALITY

Six of the forty-three eclamptic patients died, giving a mortality rate of 13.9 per cent. This, we feel, compares favorably with the mortality rate of most clinics and is only slightly more than half the generally conceded rate of 25 per cent. Of the six patients who died, three had had no prenatal care and three had had inadequate care.

The deaths from eclampsia comprised 7.5 per cent of the total maternal mortality for the period of this survey.

The uncorrected fetal mortality was 28 per cent.

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#### DISCUSSION

DR. THADDEUS L. MONTGOMERY.—From June, 1929, to June, 1935, 8,037 patients were delivered under the supervision of the Obstetrical Department of Jefferson Medical College Hospital. The incidence of eclampsia was 1 in 287 cases, 28 patients or 0.34 per cent, a proportion which agrees almost precisely with that stated in the report of the Philadelphia Lying-In Hospital. Of these 28, 12 occurred before labor (43 per cent), 5 during labor (18 per cent), and 11 following delivery (39 per cent). Several of the antepartum cases started in labor a short time after the onset of convulsions and became also intrapartum eclampsias. They have been listed only under the heading "antepartum."

There was little difference in the frequency between white and colored patients, 16 occurring among the former and 12 among the latter. Since the clinical material of the ward service is almost equally divided between white and colored, the difference of number is of no significance. Our statistics confirmed again the point that eclampsia is more common in the primigravid patient than in the multigravid. In our series there were 14 primigravid patients and 14 multigravid patients, while the proportion of registrants in the clinic is 1 to 2½, respectively. It is interesting to note that 4 of the multigravid patients were over thirty-five years of age. Multiple pregnancy occurred in one instance.

Three of the 28 patients were unregistered in the clinic, while 15 were registered, but received inadequate prenatal care through failure to attend regularly the outpatient clinic. Ten received adequate prenatal supervision which should ordinarily prevent the onset of the convulsive phase of toxemia. Therefore, of the 28 patients 64 per cent had inadequate prenatal supervision.

In method of delivery the handling of our eclamptic patient has been somewhat different from that described by the essayist. Seventeen of our patients (60 per cent) delivered spontaneously, 7 (25 per cent) by low forceps, 1 by internal podalic version and extraction, 1 by extraction of the breech, 1 by postmortem cesarean section, 1 by abdominal hysterotomy and sterilization performed at the sixth month and only after the patient had reacted and recovered from the convulsive phase of the toxemia. In 3 patients surgical induction of labor was performed. The latter operation was restricted to preeclampsia which had been under treatment and had temporarily improved, or to eclampsia which had improved after several days of conservative medical treatment.

The duration of labor of these patients was generally quite short. The longest labor recorded was thirty-three hours, in which the ultimate delivery was accomplished by low forceps, both mother and baby surviving.

There were 2 maternal deaths, a mortality rate of 7.1 per cent. The first maternal death was an unregistered patient who was admitted to the ward in a moribund condition, died within a few minutes after admission, and was delivered by a post-mortem cesarean section of a dead fetus. The second patient belonged to the group of inadequate prenatal care, was delivered at home, and died in the hospital of postpartum eclampsia.

The uncorrected fetal death rate was 8 in 28, or 28 per cent. The puerperal temperature morbidity of the mothers was 10 in 28, or 35 per cent, a considerable increase over the general puerperal morbidity of 15 per cent.

Our treatment of eclampsia in its convulsive phase is quite similar to that which has been described. We follow rather closely the methods advocated by Stroganoff, using the morphine and chloral according to the schedule which the latter has suggested. In addition, moderate dehydration is encouraged by the administration of magnesium sulphate by mouth or through the stomach tube, by the institution of a salt-poor diet as soon as the patient is able to take food, by the elimination of intake of fluid to a level below that of the output, by the administration of concentrated solution of glucose, and by the occasional, though infrequent, employment of spinal fluid drainage.

We do not believe that early emptying of the uterus offers any advantage to the patient suffering from eclampsia. We feel that twenty-four hours is too short a time in which to prepare the patient for operative delivery. We feel that it is impossible within this short period to secure sufficient sedation, sufficient unloading of the hydremic nerve and parenchymatous tissue of the individual, and sufficient restoration of the glycogen reserve. We have seen numerous instances in which three, four, and five days have passed before the patient has shown real improvement, and in many of these instances, we have been able to institute induction of labor and subsequent delivery when the convulsive phase has passed. If the emptying of the uterus were of benefit to the eclamptic patient why does such a high percentage of cases occur in the postpartum period, and why is eclampsia as fatal in the postpartum period as it is in the antepartum? While it is true that eclampsia is a metabolic disease attributable to the presence of pregnancy, yet this disease has been accumulating poisons and developing lesions over a considerable period of time, and the emptying of the uterus not only does not immediately relieve them, but in many cases it places a great additional strain upon the overburdened system.

While the results of so small a group of cases as these two offer no dependable basis of comparison, yet the burden of the proof that more radical treatment of eclampsia is preferable falls upon the shoulders of those who advocate it. Either the maternal or the fetal death rate must be decidedly smaller. I had expected, upon review of our statistics, to find that our fetal death rate would be higher, inasmuch as we postpone interference until such can be performed on the less toxic



patient, but on comparison I find our rate of 28 per cent is precisely the same as that reported by the essayists. The maternal death rate in our group of cases, while not, of course, significantly less, is, nevertheless, lower (7.1 per cent).

DR. HENRY LAFFERTY.—We have made a similar study of eclampsia at Hahnemann Medical College Hospital of all cases from 1927 to 1935. During this period there were 11,484 pregnant women admitted to the ward and private services. Forty-two developed eclampsia, an incidence of one in 273 cases. Two-thirds of these cases were in primiparas. Seventeen delivered spontaneously, 22 were delivered operatively, and three died undelivered. There were 4 cesarean sections. The maternal mortality due to eclampsia was 16 per cent; the fetal mortality, 40 per cent. Our therapy in eclampsia is similar to that practiced at the Lying-In and Jefferson Hospitals, a modified Stroganoff.

Peckham in a paper published early in 1935 in the AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY classified all the cases of eclampsia occurring at Johns Hopkins Hospital into mild and severe, feeling that such a classification was of aid in formulating a prognosis. He gave several criteria indicative of the seriousness of the case, namely, (1) temperature above 103° F., (2) pulse rate above 120, (3) systolic blood pressure above 180 mm., (4) no or very slight edema, (5) deep and persistent coma, (6) 20 or more convulsions. He stated that if two or more of these findings were present, the case was to be regarded as severe or serious. He found no deaths in 102 mild cases, and a maternal mortality of 24 per cent in 103 severe cases. In our series there were 28 mild cases with no deaths due to eclampsia, and 14 severe cases with 7 maternal deaths. The classification of a case of eclampsia into mild or severe is of great aid in prognosis, and the real problem is the treatment of the case classified as severe.

DR. EDWARD SCHUMANN.—I am committed, together with most obstetricians, to the conservative treatment of eclampsia but, occasionally, a case arises in which conservative treatment is followed by a progressive increase in the severity of the disease, and I feel that in some of these patients cesarean section, under local anesthesia, offers the best hope of success. This is particularly true in primiparas, not yet in labor, with undilated and uneffaced cervixes and a living and viable child. When such a woman fails to improve after an indeterminate time of conservative treatment, I feel that cesarean section is indicated and should be done.

The published statistics, regarding the very high mortality of section in these cases, are subject to criticism, because in many instances the operation was done in desperation and as a last resort, when the patient was practically moribund. It should be emphasized that I am not an advocate of hysterotomy as treatment for eclampsia, but I feel that one should not be deterred from the employment of this operation when clear indications are present for its use.

DR. JOHN C. HIRST.—May I contribute my summary of statistics on 7,292 consecutive planned pregnancies beyond the twentieth week of gestation. These were collected from the four following sources: (1) the University of Pennsylvania ward, from 1931 to 1934, 3,157 cases with 6 cases of eclampsia and no deaths; (2) the Methodist Hospital ward, 1,070 births with 3 cases of eclampsia and no deaths; (3) the Preston Retreat, from 1931 to 1935, 2,510 births, with 8 cases of eclampsia and no deaths; and (4) personal private cases to date, 1,555 consecutive births, with 3 cases of eclampsia and no deaths. That makes a high incidence in 7,292 planned deliveries with adequate prenatal care, of 1 case in 364 births, but there were no deaths among any of these eclamptic patients.

DR. KIMBROUGH (closing).—I think we have to be on guard against being too confident concerning our statistics when dealing with such small groups of cases.

## THE NONPROTEIN, UREA, AND REST NITROGEN OF THE BLOOD DURING NORMAL PREGNANCY AND THE PUERPERIUM

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IT IS generally agreed that normal pregnancy is accompanied by a decrease in blood urea nitrogen. A survey of the literature, however, reveals great disagreement among various investigators as to absolute figures observed during gestation, reported average values ranging from 6.8 to 12.5 mg. per 100 c.c. of blood. As the average urea nitrogen content of the blood in the normal nonpregnant state does not fluctuate between very wide limits, our interest in the reported pregnancy variations at once becomes apparent. Before reliance can be placed on any abnormal findings in the urea nitrogen content of the blood, as has been reported in certain of the toxemias of pregnancy, it becomes essential that the normal pregnancy values be established. Should the wide variations referred to above be corroborated, then too great importance should not be placed upon some of the findings reported in certain of the toxemias. Furthermore, the problem then arises as to the factor or factors involved in bringing about such variations. On the other hand, it is conceivable that differences in method or technic might be accountable for the different values reported. The values referred to have been obtained by the use of different methods, such as that of Folin and Denis, Folin and Wu, Van Slyke and Cullen, or Leiboff and Kahn, or the gasometric urease method of Van Slyke.

For accurate estimation of blood urea nitrogen by any method involving the use of urease it is essential that certain factors, such as the hydrogen ion concentration, the type of buffer used, and the temperature, be carefully regulated. In other words, the determination of urea nitrogen by means of urease is a more tedious procedure than is generally supposed. Considering this point we should like to point out that although practically all of the workers have reported the nonprotein nitrogen to be in the neighborhood of 25 mg. per 100 c.c. of blood, their urea nitrogen values have varied so greatly that we are inclined to believe that some of the discrepancies of the reported urea nitrogen values are due either to difficulties in the analytical technic or to the fact that in some instances the average values for the ten months of pregnancy were based on as few as five cases. Inasmuch as all of the workers, ex-

cepting one who conceded that the procedure he used was inaccurate, have used methods involving urease, we felt that it would be desirable to carry out a series of blood urea nitrogen determinations on normal pregnant women, using a blood filtrate and a method which does not require the use of urease.

## METHODS

Filtrates prepared from whole blood by the procedures of Somogyi and Folin-Wu were used for the determination of urea nitrogen and nonprotein nitrogen, respectively. Urea nitrogen was determined by the manometric hypobromite method of Van Slyke and Kugel, and the procedure was frequently checked by analyzing solutions containing known amounts of urea. The method of Folin and Wu was used for nonprotein nitrogen analyses; and the rest nitrogen was calculated as the difference of the two.

By "rest nitrogen" we indicate all the nonprotein nitrogen of the blood excepting the urea nitrogen, in contradistinction to "Undetermined Nitrogen" which not only excludes the urea nitrogen but also the amino acid, uric acid, creatine, and creatinine nitrogen.

In reporting our values we have considered them in respect to the month, as well as the entire duration of pregnancy. The lunar month was calculated from the time of the last menstrual period. In order to have approximately the same number of cases in the various stages of pregnancy, we have considered the second and third, the fourth and fifth, the sixth and seventh, the eighth and ninth months, and the tenth month as individual intervals. Thus, we have 18 cases in the first, 28 in the second, 33 in the third, 28 in the fourth and 25 cases in the fifth group, making a total of 132 cases for the entire duration of pregnancy.

TABLE I. NONPROTEIN NITROGEN

NONPROTEIN NITROGEN MG.	SECOND MONTH	THIRD MONTH	FOURTH MONTH	FIFTH MONTH	SIXTH MONTH	SEVENTH MONTH	EIGHTH MONTH	NINTH MONTH	TENTH MONTH	TOTAL CASES
19-19.9					1				1	1
20-20.9					1		1		1	3
21-21.9				1	2			1		4
22-22.9		1		5	7	3	1		2	19
23-23.9					3	1	3	2	2	11
24-24.9		1		2	2	2	6	1	1	15
25-25.9	1	1	3	3		2	2	5	8	25
26-26.9		3	2	1	6	1	2	1	5	21
27-27.9	3		3	1		1		1	2	11
28-28.9		1		2				1		4
29-29.9	2	1	2	1		1			1	9
30-30.9	1	1	1					1	2	5
31-31.9		1								1
32-32.9										0
33-33.9		1	1						1	3
Total	7	11	12	16	22	11	15	13	25	132
Total	18		28		33		28		25	132
Av. deviation ± Prob. error	28.00 ± 0.39		26.25 ± 0.33		24.04 ± 0.26		24.89 ± 0.22		26.08 ± 0.37	25.62 ± 0.16
Std. deviation ± Prob. error	2.66 ± 0.30		2.65 ± 0.24		2.20 ± 0.18		1.89 ± 0.15		2.74 0.26	2.74 ± 0.11
	First Group		Second Group		Third Group		Fourth Group		Fifth Group	

Table I shows the distribution of the values in regard to the nonprotein nitrogen content of the blood in each month of pregnancy. The total number of cases for the entire duration of pregnancy for each interval of 1 mg. per 100 c.c. of blood is given in the last column of this table.

From an inspection of the frequency table one may conclude that from the second to the sixth month, there is a gradual decrease in the non-protein nitrogen content of the blood and that it then rises during the latter part of pregnancy. A study of the averages confirms this impression. From an average of 28.00 mg. per 100 c.c. of blood in the first group, the nonprotein nitrogen content falls to a value of 24.04 mg. in the third group. From this time it gradually increases and attains an average value of 26.08 mg. in the fifth group. Although this latter value is still somewhat lower than the average for the first group, it is at the same level as that of the second group. Since the range of  $\pm$  two sigma (standard deviation) includes 95.4 per cent of the cases we might say that the nonprotein nitrogen range during the period of a normal pregnancy is from 20 to 31 mg. per 100 c.c. blood.

#### UREA NITROGEN

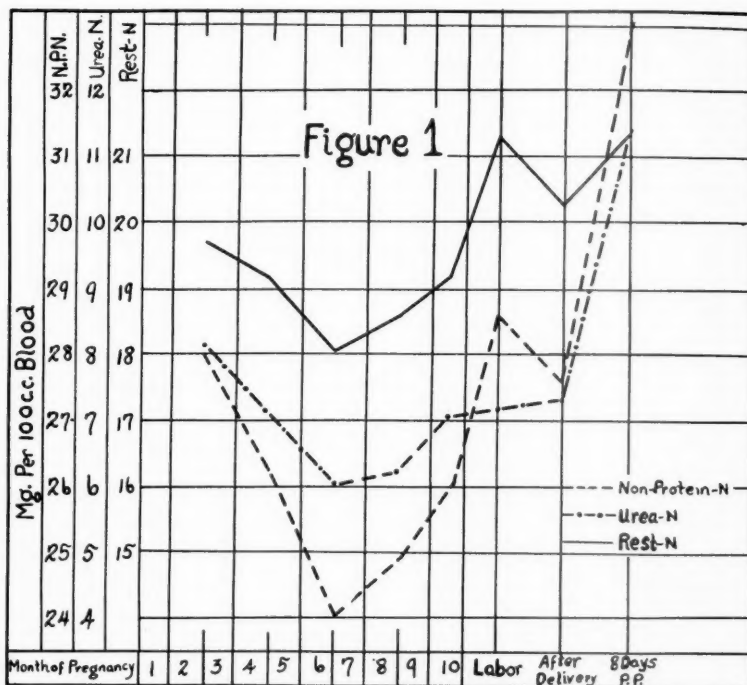
The values for blood urea nitrogen are given in Table II. These, like the non-protein nitrogen values, decrease during the early part of pregnancy reaching the lowest point during the sixth month. However, the blood urea nitrogen does not begin to increase until some time during the eighth or ninth month. By the tenth month it has increased sufficiently to have a value of the same magnitude as the average for the second and third months or the first period. For the entire duration of pregnancy, the average is 6.82 mg. per 100 c.c. of blood with a standard deviation of plus or minus 1.62. Since 94.5 per cent of the values fall within the range of plus or minus twice the standard deviation, we can say that 3.6 to 10 mg. per 100 c.c. of blood is the range for the blood urea nitrogen for the period of normal gestation.

TABLE II. UREA NITROGEN

UREA NITROGEN MG.	SECOND MONTH	THIRD MONTH	FOURTH MONTH	FIFTH MONTH	SIXTH MONTH	SEVENTH MONTH	EIGHTH MONTH	NINTH MONTH	TENTH MONTH	TOTAL CASES
3-3.9				1	2	1	1			2
4-4.9					2	2	2			12
5-5.9		1	1	5	10	3	5	3		31
6-6.9		4	3	3	7	3	2	1	10	33
7-7.9	2	1	4	2	1	1	4	4	5	24
8-8.9	3	2	1	5	2	1	1	2	2	19
9-9.9	1	1	2						1	5
10-10.9	1	2							1	4
11-11.9			1						1	2
Total	7	11	12	16	22	11	15	13	25	132
Total	18		28		33		28		25	132
Av. deviation									7.06	6.82
$\pm$ Prob. error	8.16 $\pm$ 0.23		7.09 $\pm$ 0.18		6.04 $\pm$ 0.15		6.25 $\pm$ 0.18		$\pm$ 0.22	$\pm$ 0.09
Std. deviation									1.63	1.62
$\pm$ Prob. error	1.49 $\pm$ 0.17		1.48 $\pm$ 0.13		1.27 $\pm$ 0.10		1.42 $\pm$ 0.13		$\pm$ 0.15	$\pm$ 0.07
	First Group		Second Group		Third Group		Fourth Group		Fifth Group	

## REST NITROGEN

When comparing urea nitrogen and nonprotein nitrogen values, we find that they both decrease from the second to the sixth month. The urea nitrogen, however, remains constant until the eighth or ninth month, while the nonprotein nitrogen rises from the sixth month until term. This is clearly shown in Fig. 1. The nonprotein nitrogen falls at a faster rate than the urea nitrogen, resulting in a decrease of 1.64 mg. per cent of rest nitrogen. The rest nitrogen then begins to increase and continues to do so until term, at which time it has reached a value similar to that of the second group.



Studies made by numerous workers on the plasma and serum proteins, the specific gravity, the water content, and the total solids of the blood indicate that there is a dilution of the blood during pregnancy, with the maximum occurring during the sixth or seventh month. In the latter part of pregnancy the water content of the blood decreases as term is approached. From this, we may conclude that the rest nitrogen follows a course approximately parallel to that of plasma volume and that the substance or substances responsible for the changes may be in either plasma or in the cells. In view of the fact that creatine and glutathione are two nitrogenous substances which occur exclusively in the cells, we believe that a study of the concentration of these substances in whole blood in conjunction with the cell volume would be of interest. Work along this line is now being carried out in this laboratory.



## THE PUERPERIUM

In Table IV are given the values obtained from the same patients in the last month of pregnancy, during labor, immediately following delivery, and eight days postpartum.

According to the values thus obtained, we find that the nonprotein nitrogen, urea nitrogen, and rest nitrogen, eight days postpartum, are

TABLE III. REST NITROGEN

REST NITROGEN MG.	SECOND MONTH	THIRD MONTH	FOURTH MONTH	FIFTH MONTH	SIXTH MONTH	SEVENTH MONTH	EIGHTH MONTH	NINTH MONTH	TENTH MONTH	TOTAL CASES
13-13.9					1					1
14-14.9				1						1
15-15.9		1			4				1	6
16-16.9			1	6	3		2	2	2	16
17-17.9	1	3		2	6	2	1	1	3	25
18-18.9	2		3		4	2	2	3	8	24
19-19.9	2	2	1	1	2	6	2	4	3	23
20-20.9		1	4	4	1	1	1	1	4	17
21-21.9	2	2	1	1	1		1	2	2	12
22-22.9		1	1	1						3
23-23.9			1						2	3
24-24.9		1								1
Total	7	11	12	16	22	11	15	13	25	132
Total	18		28		33		28		25	132
Av. deviation ± Prob. error	19.67 ± 0.37		19.16 ± 0.31		18.03 ± 0.20		18.60 ± 0.19		19.18 ±0.28	18.81 ±0.12
Std. deviation ± Prob. error	2.17 ± 0.24		2.44 ± 0.22		1.72 ± 0.14		1.52 ± 0.14		2.06 ±0.19	2.00 ±0.08
	First Group		Second Group		Third Group		Fourth Group		Fifth Group	

markedly increased over the corresponding values for the tenth month. We do not wish to stress our findings at parturition, inasmuch as we have only a few cases. However, from the averages we may tentatively say that the nonprotein nitrogen decreases during parturition with a corresponding lowering of the rest nitrogen. The urea nitrogen is apparently unaltered. Further study of this point is necessary before we could draw definite conclusion. In connection with this point it would be very interesting also to follow any changes that might occur in cell volume and glutathione.

## DISCUSSION

Earlier in this presentation we have pointed out that values averaging from 6.8 to 12.5 mg. of urea nitrogen per 100 c.c. of blood have been reported as the average for the ten months of pregnancy. In Table V are given the findings of various authors. From this table one may readily see that only 3 of those listed had 50 or more analytical figures on which to base their conclusions. We shall therefore compare our results with these three only.

TABLE IV

CASES	TENTH MONTH			DURING FIRST STAGE			AFTER THIRD STAGE			EIGHTH DAY POSTPARTUM		
	N.P.N.	UREA N.	REST N.	N.P.N.	UREA N.	REST N.	N.P.N.	UREA N.	REST N.	N.P.N.	UREA N.	REST N.
Case 1 T. S.	21.40	4.70	16.70	29.10	6.10	23.00						
Case 2 V. M.	26.4	10.1	16.3	31.2	8.8	22.4	26.60	6.20	20.40	36.00	10.10	25.90
Case 3 C. D.	25.0	6.8	18.2	34.9	9.5	25.4						
Case 4 M. H.	30.0	7.1	23.0	31.4	7.2	24.2	36.4	11.1	25.3	44.5	21.2	23.3
Case 5 E. T.	23.3	6.4	16.9	29.6	8.3	21.3	27.2	7.4	19.8		7.2	
Case 6 M. D.	25.1	6.7	18.4	24.0	6.4	17.6	26.0	7.5	18.5	30.3	9.3	21.0
Case 7 R. K.	25.5	6.7	18.8	31.1	6.8	24.3	30.0	7.0	23.0	32.1	11.1	21.0
Case 8 G. C.				22.2	5.1	17.1	24.7	5.9	18.8	39.7	13.0	26.7
Case 9 E. P.				24.0	6.9	17.1	22.5	6.5	16.0	32.2	11.1	21.1
Case 10 E. C.	27.1	7.7	19.4							30.8	10.7	20.1
Case 11 P. W.	33.3	9.6	23.7							29.1	9.4	19.7
Case 12 B. A.	26.9	5.7	21.2							30.6	8.9	21.7
Case 13 A. M.	25.0	6.5	18.5							33.3	13.2	20.1
Case 14 C. P.	30.8	11.1	19.7							32.1	13.3	18.8
Case 15 M. A.	22.3	4.6	17.7							29.0	8.8	20.2
Case 16 F. A.	25.8	6.4	19.4							30.9	11.2	19.7
Case 17 J. B.	25.4	7.1	18.3							33.1	13.2	19.9
Case 18 E. P.	23.5	6.7	18.8							32.4	10.7	21.7
Average	26.04	7.12	19.02	28.61	7.27	21.38	27.63	7.37	20.26	33.14	11.40	21.39
Std. dev.	2.26	1.44	2.05							2.92	1.57	2.56

Our findings are in complete agreement with those of Folin. The non-protein and urea nitrogen curves follow rather closely those of Bunker and Mundell, excepting that our urea nitrogen values are considerably lower. We concur in the conclusion of Caldwell and Lyle

TABLE V

AUTHOR	YEAR	NO. CASES	N.P.N.	UREA N.	REST N.	UREA N.
						N.P.N.
Farr, Williams	1914	10	25.6	10.0	15.6	0.41
Slemons and Morris	1916	35	25.2	10.4	14.8	0.44
Folin	1917	100	less than 30	4 to 9		0.20 to 0.35
Killian and Sherwin	1921	5	23.0	10.4	12.6	0.45
Caldwell and Lyle	1921	150	29.7	11.5	18.5	0.39
Hellmuth	1923	8	24.0	7.7	16.3	0.32
Bunker and Mundell	1924	52	25.0	12.5	12.5	0.50
Hurwitz and Ohler	1932	4	30.0	6.8	23.2	0.23
Dieckmann	1935	23	23.8	12.2	11.6	0.51

in that, "In normal pregnancy, as compared with the nonpregnant state, we find a low total nonprotein nitrogen, low urea nitrogen and a very low ratio of urea nitrogen to the total nonprotein nitrogen."

## SUMMARY

The nonprotein, urea, and rest nitrogen were determined in 163 blood specimens, obtained from normal pregnant women at different periods of gestation, during labor, and on the eighth day postpartum. Although nitrogen determinations were not performed on any one patient throughout the course of her pregnancy, we believe that the data we have obtained warrant the following conclusions regarding normal gravidity, especially as we have given due attention to the statistical distribution of our figures.

## CONCLUSIONS

1. The nonprotein nitrogen of the blood decreases during the first six months of pregnancy from the average nonpregnant values of approximately 30, to 24 mg. per 100 c.c. of blood.
2. During the last four months of pregnancy the nonprotein nitrogen increases steadily until one week postpartum when it averages 33 mg. per 100 c.c. of blood, being about 26 mg. at term.
3. The urea nitrogen concentration diminishes during the first six months from the usual nonpregnant value of about 14 mg. to a value of 6 mg. per 100 c.c. of blood; and then maintains a constant level until the eighth or ninth month, when it begins to rise, having an average value of 7.12 mg. at term and 11 mg. per 100 c.c. blood on the eighth day postpartum.
4. Due to the fact that the nonprotein nitrogen falls and rises more rapidly than the urea nitrogen, the rest nitrogen falls during the first

six months of pregnancy to a value of 18.02 mg. per 100 c.c. of blood and then increases during the latter part of pregnancy, being 19.18 mg. at term. It is further increased during the first week postpartum, reaching a value of 21.39 mg. on the eighth day of the puerperium.

5. Although it is quite evident that a change in the rest nitrogen is not necessarily accompanied by a change in the  $\frac{\text{U.N.}}{\text{N.P.N.}}$  ratio, our figures show that the urea nitrogen to nonprotein nitrogen ratio is decreased during pregnancy, being 0.25 during the sixth or seventh month and 0.27 at term. The normal nonpregnant value for this ratio is approximately 0.50.

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**Patoir, André, and Patoir: Poisoning With Apiol, Paris méd. 25: 397, 1935.**

Apiol is widely advertised as a so-called emmenagogue and extensively used as an abortifacient. It is supposed to be nontoxic though occasionally cases have been reported where mild poisoning had followed the use of this preparation either in large doses or for a long time. More recently new attention has been directed toward this drug by the reports of instances of polyneuritis and nephritis. A polyneuritis epidemic in the U. S. a few years ago following the use of Jamaica rum had been definitely traced to its contents of triorthocresyl phosphorous ester. A similar sudden accumulation of cases of polyneuritis in Germany has been found to be due to extensive use of creosote phosphate in pulmonary affections. The apiol polyneuritides observed in France (also in U. S.) revealed in their symptomatology and course a striking similarity to those previously mentioned. This is probably satisfactorily explained by the fact that in various apiol preparations on the market triorthocresyl phosphorus has been discovered.

After a variable delay the first symptoms of intoxication appear in the legs, especially toes, gradually proceeding to paralysis. About a week later the hands become involved. If medication is not stopped, serious and even fatal hepatonephritis will develop. Abortion actually results not as a direct result of the apiol but as part of the general impairment of the patient through renal breakdown, emaciation, often fever.

For obvious reasons only a few even of the serious cases are reported. The free sale of apiol should be prohibited.

HUGO EHRENFEST.

## THE SIGNIFICANCE OF FETAL HEART TONES IN ABLATIO PLACENTAE\*

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THE individual life span is all too short for anyone to experience, in practice, all obstetric possibilities. Nor is it within the bounds of a single obstetric text, or system of obstetrics, to describe, to prognosticate, and to treat all obstetric conditions with their numerous variations.

A text, therefore, must represent the experiences of the author, or editor, together with such facts and figures as are gleaned from preceding literature and other sources of information. Too often, however, a statement is handed down from one writer to another to be accepted, and passed on, as fact, without challenge or compromise.

It is by way of friendly challenge that this subject, "The Significance of Fetal Heart Tones in Ablatio Placentae," is presented for the first time, and only after a careful search of the literature had revealed that an evaluation of the fetal heart tones in ablatio had never, apparently, been published.

On Sept. 20, 1901, Holmes<sup>1</sup> presented before this society his Inaugural Thesis, "Ablatio Placentae," based on the study and analysis of 200 cases. In this thesis, which today, thirty-four years later, still retains its position as the classic on ablatio placentae, Holmes warned that "The condition of premature detachment of the normally situated placenta is one which has been given insufficient attention by obstetricians; that its frequency has been greatly underestimated; its mortality judged too high, and that its treatment is still a moot question."

In concurring with Holmes, with some degree of modification and reservation, attention might well be directed to the literature dealing with ablatio placentae, from which it is evident that too trivial consideration is accorded to the fetal heart tones, although these have a definite importance in this complication.

We are only too familiar with the almost universal expressions of authors, who dismiss the fetal heart tones in placental separation with such statements as "The fetal heart tones disappear," "after a period of unusual fetal activity the heart tones cease," or in extremes, "the heart sounds are not heard," or "are absent."

\*Read at a meeting of the Chicago Gynecological Society, February 21, 1936.



Williams<sup>2</sup> (*Obstetrics*) states, "In concealed hemorrhage . . . as the child is dead, auscultation gives negative results. . . . When the premature separation of the placenta occurs at the time of labor . . . the hemorrhage is usually external and the fetal heart sounds suddenly become imperceptible." He makes no other reference to fetal heart tones.

DeLee,<sup>3</sup> discussing symptoms, diagnosis, and treatment, refers to fetal activity and fetal heart tones as follows: "During pregnancy . . . the woman says that the child is not felt, but that it was subject to violent movements at the onset of the accident. Very seldom can the fetal heart be heard, and under such conditions a partial separation of the placenta must be assumed. . . . During labor . . . the accoucher, attentively observing the fetal heart tones, discovers the agitation of the child." In diagnosis and differential diagnosis he refers only to "absence of fetal heart tones" and "cessation of fetal movements." Under treatment he states, "If the hemorrhage continues, and especially if the fetal heart tones become irregular or slow, a diagnosis of abruption is now made, and the child should be delivered without delay. . . . The accoucher must sit by his patient watching every change in her condition closely. . . ."

Hirst<sup>4</sup> makes no mention of fetal heart sounds, except to say, in his differential table, that they usually disappear. Vaux<sup>5</sup> makes no mention of fetal heart sounds. Cooke,<sup>6</sup> writing the section on "Premature Separation of the Placenta" in Curtis' *System of Obstetrics and Gynecology* says: "The absence of fetal heart sounds may or may not be of significance. . . . A marked and progressive increase or decrease in the fetal heart rate followed by cessation of the sounds, is seriously suggestive of fetal death. . . ." Holmes,<sup>7</sup> in the chapter on *Ablatio Placentae* in Davis' *Gynecology and Obstetrics*, writes: "If the fetal circulation is cut off suddenly by a widespread placental separation, the sudden asphyxia will cause violent fetal movements, then the quiet of death will supervene. If the arrest of circulation is slow, the marked activity of the fetus will be absent, and the child gently passes into death."

Treatises on premature separation of the normally implanted placenta, reviewed in the literature, present about the same brief summation regarding fetal heart tones as these citations from a representative group of obstetric works. Davis and McGee's<sup>8</sup> statements relative to the fetal heart contain probably the greatest significance of any found in the literature. They say that "On auscultation of the fetal heart one finds evidences of fetal asphyxia demonstrated by an irregularity in rhythm or a decrease in rate," and under diagnosis, "The diagnosis of partial abruptio placentae can be made by the sudden change in the character of the labor; the external hemorrhage, and the signs of fetal asphyxia as indicated by the slowing of the fetal heart rate." Discussing treatment these writers report cases of sudden change in character of labor, external hemorrhage, tenderness, early uteroplacental apoplexy, and decreased fetal heart rate, adding "this is the only case of this kind in which we were able to deliver a live baby."

That last statement strikes at the keynote of this paper. It strikes at the veritable cause of the high mortality rate of mother and fetus. It was almost too late. How many times are we almost, if not actually, too late to save the mother only, when by earlier recognition both might have been living!

The literature teems with discussions and reports of cases where one of three conditions prevailed: first, the patient came under observation too late; the sequence of events was too fulminating; or, our diagnosis was either too slow or treatment was deferred through too much "watchful expectancy" in which the attention was directed toward the rapidly failing condition of the mother, and with little or no regard for the fetal heart tones which present one of the earliest and most significant signs.

Not only do the fetal heart tones present the *earliest* indication in premature separation of the placenta, but they are always altered in so definite a manner as to direct our suspicion positively toward a placental detachment. I desire at this time to present an adequate evaluation of the significance of the heart tones in this condition as to attract more careful and deeper study in this most serious obstetric condition.

Besides the lack of a proper evaluation of the fetal heart sounds, the term "abruptio placentae" used by some authors and writers, is without a doubt directly conducive to a deferred diagnosis and resultant delay in treatment with a consequent higher mortality of mother and fetus. The word abruptio in its literal sense conveys the idea of suddenness, haste, and a forcible breaking off. Abruptio may be defined as a sudden breaking off, a violent separation of bodies and as unceremonious. Therefore, abruptio placentae defines etiologically only one, and the smallest, group of premature placental separations, namely those which occur suddenly and completely in some instances, but even in these the process is not a sudden breaking off, but rather an orderly process of cleavage by hemorrhage between placenta and uterus. Nor is it unceremonious. Previa, too, when bleeding, is a process of separation.

Stormy as it may be, there is probably no condition in obstetrics which is so ceremonious in its course as ablatio placentae. The event pursues a definite and methodical progression of incidents, which occur in an identical sequence without regard to the time factor involved, whether it be five minutes or five hours.

This sequence may be indicated as,

1. Hemorrhage (or separation).
2. Placental separation with increasing hemorrhage (both progressive).
3. Decreased oxygenation and increased fetal carbon dioxide retention.
4. Fetal embarrassment with compensatory acceleration of fetal heart rate.
5. Fetal heart compensation to maximum tolerance.
6. Asphyxia with decreasing fetal heart rate.
7. Placental separation complete either before, or after.
8. Fetal death, quiet or violent.

In considering singly this orderly and significant program in such a catastrophe it matters little which precedes, the hemorrhage or the separation. Either could produce the other; also, either could result from the other. Both are progressive, and as the all-important time factor

advances, the fetus responds with an acceleration of the heart rate. This occurs at a point somewhere between zero and a separation of about one-fourth of the placental area and agrees in proportion to the amount of separation and the temporal factor which may be referred to as time.

The acceleration of the heart rate is a regular physiologic process which can be expressed in figures which correspond to the degree of separation and time, and will be so expressed hereafter. Any separation of placenta, however slight, obviously alters the oxygen and carbon dioxide exchange between placenta and placental site, or between fetal and maternal organisms. The slight crescentic separations so familiar at the margin of placentas do not sufficiently alter the  $O_2 - CO_2$  exchange as to affect the fetal heart rate. This group should be considered as comprising those of lesser clinical importance which Holmes<sup>9</sup> refers to as occurring once in 200 cases. They deliver spontaneously and without evidence of previous separation until the placenta is inspected after the third stage of labor and the crescentic area of the marginal clot is discovered.

As placental detachment increases, the oxygen-carbon dioxide exchange is so altered as to produce fetal heart embarrassment, to which the fetus responds with a compensatory acceleration in the heart rate. Since the oxygen-carbon dioxide balance is directly dependent upon the area of placenta and placental site, that balance will be impaired in direct proportion to the amount of placenta detached. The fetal requirements for oxygen and its necessity of carbon dioxide elimination remain rather constant for a given period. Since the fetal circulation is the sole agent for oxygen delivery and carbon dioxide dissemination, that circulation should and does speed up in a direct relation to the ever diminishing available area of placental attachment. This constitutes a compensatory phase in which the fetal heart becomes continuously more rapid until the functioning placental area becomes so small that it no longer suffices to maintain an oxygen-carbon dioxide balance. Oxygen is deficient,  $CO_2$  overwhelming, asphyxia ensues, and the fetal heart rate slows down with advancing detachment until ablation nears or reaches completion. In this phase of asphyxia, characterized by a failing heart muscle, and an ever slowing fetal heart rate, fetal death occurs quietly in prolonged cases, and with violent fetal activity where ablation is rapid.

There are two exceptions, and probably only two, to this uniform scheme in ablation. The first is that group of cases in which the time element is too great in any one phase for the fetal heart muscle to withstand the exhausting rapidity of its effort to exchange oxygen and carbon dioxide. The second comprises a small number of cases in which the hemorrhage is external quite early and the egress of blood so rapid that the placental site is drained too swiftly for the fetus to acquire oxygen in spite of its circulatory activity.

The physiologic response of the fetus to ablatio is uniform and uninterrupted from beginning to end. The case reports will place a numerical value upon these physiologic responses, which evaluation, it is hoped, will inspire more scientific attention than mere watchful expectancy, and will demand earlier diagnosis and more prompt interference.

On Nov. 7, 1932, Dr. J. K. McQuarrie referred the case which prompted a study of fetal heart tones in ablatio placentae. This case was such as to make it immediately obvious that the heart tones could and should be used to great advantage as a diagnostic and prognostic aid. Then it happened that in the following three years eight more such cases, all of the grave type, came to observation, and these, with the first one mentioned, have made the completion of findings possible in all stages of placental separation.

#### CASE REPORTS

CASE 1.—Mrs. K., white, para i, aged twenty-five. Pregnancy normal, highest blood pressure 116/70. Urinalysis negative throughout. No bleeding or toxic symptoms during pregnancy. Entered hospital at 8 A.M. Dec. 7, 1932, in labor at term, with history of membranes having ruptured at 6 o'clock. After rectal examination which revealed no dilatation and head high, the patient was prepared for delivery. The maternal pulse was 76, fetal 140. At 9 A.M. a visible, external hemorrhage occurred and the amount was estimated at 50 c.c. There was no pain. The mother's pulse was 88, fetal 140. At 9:40 A.M. the dilatation was 1 cm. At 10:40 the fetal heart tones were 140. Rectal examination revealed dilatation still 1 cm. No boggy mass, no placental pulsation, and no undue thickness of tissue could be palpated between the rectal finger and the presenting head. No bleeding followed the rectal examination. Ablatio placentae was diagnosed.

At 11:20 A.M. a second hemorrhage occurred, this time between 50 and 100 c.c. and again without pain, other than the labor pains which were weak, irregular, and unproductive. Dilatation was still only 1 cm. at 11:30 A.M., but the fetal heart tones had increased in rate to 160. They were strong, full, and rapid. The mother's pulse was now 92, and it was observed that while the uterus was not painful, it was tender, and now failed to relax as completely as formerly, though not of ligneous hardness.

The patient and husband were told that while the baby was markedly embarrassed, it was in good condition (barring atelectasis) but that without interference, and with a failure of progress, that the baby would succumb to the placental separation, which might later require cesarean section for a dead baby in order that hemorrhage might be checked in behalf of the mother.

Low cervical cesarean operation was performed and a live infant delivered. It cried immediately, as it was overloaded with CO<sub>2</sub> but delivered still in the stage of compensation.

Lest bleeding and the first uterine contraction should produce further placental separation the infant was immediately intrusted to an associate, and the uterus was invaded to determine the degree of placental separation that had caused the fetal heart to increase from 140 to 160. The placenta was found high on the posterior wall of the uterus, with one-fourth to one-third of its lower portion separated. There were some recent clots and about 350 to 400 c.c. of fluid blood between the uterine wall and the placenta and membrane.

There had been no injury, yet a painless hemorrhage had taken place, one just as causeless, if such can be said, as in placenta previa, yet not a placenta previa. Known duration of separation was three hours fifty-eight minutes.

Recovery was uncomplicated. Mrs. K. has had one normal delivery since, and one precipitate in an ambulance en route to the hospital.

CASE 2.—Mrs. S., white, para ii, aged twenty-five years. Prenatal care uneventful. Term date estimated at March 8, 1933. Highest blood pressure 120/70. Urinalysis normal. No toxemia. Fetal heart tones last prenatal visit 136, March 3, 1933.

The next day, March 4, 1933, labor began at 6 P.M. Patient entered hospital at 7 P.M. She had about 100 c.c. of external bleeding. Placenta previa was diagnosed by the interne. This was corrected by myself, and diagnosis, rectally and by history, of ablatio placentae was made.

Fetal heart tones on admission were 132, at 9 P.M. they were 150 and dilatation was complete. There was no pain except from the contractions but the uterus was tender. Delivery was spontaneous at 9:35 P.M. The placenta was expelled at 9:40 P.M. with a blood loss of 300 c.c. One-fourth of the placental surface was covered with clot in evidence of the area detached.

The known duration of the separation was two hours and thirty-five minutes. The uterus, while it failed to relax completely between pains, never even approached the so-called ligneous hardness.

The newborn respirations were spontaneous and prompt.

CASE 3.—Mrs. B., white, para ii, aged thirty-three years. This patient was seen seven times prenatally. Urinalysis was normal. The highest blood pressure was 118/70. The fetal heart tones during pregnancy were 136.

On Nov. 8, 1933, at 2 A.M. she called the doctor to say she had been awakened by a severe hemorrhage. She was not in labor, had no pains, and was three or four weeks from term.

Mrs. B. entered the hospital an hour later, though not in labor nor in pain, but with what the nurses described as a large amount of bleeding. Examination at 3:10 A.M. revealed no dilatation, head floating, O.L.A., fetal heart tones 162. The interne made a diagnosis of placenta previa.

Examination revealed fetal heart 170 and maternal pulse 148, respiration 24, a uterus tender but not painful, not fully relaxing between pains, but not ligneous by any means.

Low cesarean operation was performed at 5 A.M. and a live viable baby was delivered. The placenta was high on the posterior wall of the uterus, with one-half its area separated.

The known duration of ablatio here was three hours.

CASE 4.—Mrs. D., white, para ii, aged thirty. Seen seven times prenatally. Urinalysis normal. Last prenatal visit fetal heart tones were 136, blood pressure 98/54, April 2, 1934.

On April 6, 1934, patient phoned at 6:30 A.M. that she had had some bleeding since 6 A.M., but no pain. She was then beginning the seventh month of gestation.

She was admitted to the hospital two hours later though not in labor and still bleeding without any pain.

At 8:05 A.M. the head was floating, the os was undilated, and the uterus was tender, somewhat firm and not hard. Fetal heart tones were 170 to 180, bag of waters intact, maternal pulse 94, and respiration 18. Fetal heart tones began to decrease and by the time of the operation had slowed to 120. The phase of asphyxia was in progress. The mother's condition was good but while fetus was premature, labor did not begin and severity of signs and symptoms made it apparent that section might be necessary, in absence of labor, to control blood loss of mother.



Section was done at 9:30 A.M. and a small premature, moderately asphyxiated infant of three and three-fourths pounds was delivered. The placenta was high on posterior wall of the fundus and separated in its lower one-half.

The known duration of the ablatio was three hours and thirty minutes.

The baby respired but succumbed to prematurity eight hours after delivery.

CASE 5.—Mrs. S., white, para i, aged thirty-six, was a known diabetic for eight years. She had had two amputations of right leg, and was taking maintenance doses of U 10 insulin morning and evening. She was advised against childbearing but was determined to become a mother. The last menstruation began Feb. 1, 1933, which would bring her to term about Nov. 8, 1933.

She had slight bleeding Sept. 17, 1933, at about 6 P.M. (fluid blood, not a bloody mucus). She was in labor and the fetal heart tones were 160 and good quality. Immediate hospitalization was advised.

She entered the hospital Sept. 17, 1933, at 8:25 P.M. with profuse bleeding and a blood pressure of 180/105. Abdomen was tense. The fetal heart tones were reported by the interne as 140 and were never heard again. This decrease in rate over that of two hours previous was evidently due to the asphyxia phase of placental separation. The first stage was five hours eleven minutes, second stage forty-five minutes. The placenta was expelled with the baby; separation had been complete. The patient, mentally uncertain on admission, was semicomatose at delivery but recovered.

Known duration of separation was six hours sixteen minutes.

CASE 6.—Mrs. A., white, para i, aged twenty-five. Last menstruation June 1 (?), 1934, term March 10 to 15, 1935. Fell on stairs Feb. 27, 1935. Fetal heart tones during pregnancy 144.

March 4, 1935, she had a severe headache at 8 A.M., and at noon a hemorrhage occurred and was estimated by patient to be easily one-half teacup in amount. Headache ceased immediately after onset of bleeding. Hemorrhage was painless and followed in ten minutes by a second painless and so-called causeless hemorrhage, which did not cease entirely until delivered. There was no pain until after arrival at the hospital at 3:15 P.M. on March 4.

Bright red blood appeared externally. Fetal heart tones were absent. Maternal pulse was 100. The first examination of patient was at 5:30 P.M. when bleeding was moderate, uterus larger than normal, tender and of ligneous hardness. Diagnosis of ablatio placentae was made and cesarean section advised, in spite of dead fetus, to control bleeding since the irregular labor had effected no progress. Couvelaire uterus was also given serious thought. Uterine pain began three and one-half hours after first hemorrhage. Labor pains began three and one-fourth hours after first hemorrhage.

Section was done and the fetus was found to be dead, placenta completely separated, and small subserous hemorrhagic areas were found over placental site on anterior wall of uterus. The uterus was not removed.

CASE 7.—Mrs. O., white, para ii, aged thirty-six years, was toxic in first and present pregnancy. Albuminuria varied from slight to moderate with some casts. Toxemia was on renal basis. Blood pressure increased from 110/70 to 160/80. Fetal heart tones last prenatal recording were 144. She entered hospital at 2:15 P.M. April 8, 1936, and was examined at 2:30. There were no fetal heart tones. Cervical dilatation was 7 cm., and patient was sent to the delivery room. Membranes ruptured at 3:25. Delivery occurred at 3:32 P.M. Placenta was retained by a contraction ring and had to be removed. It showed evidence of old separation over three-fourths of its area, but without bleeding. There was no history of bleeding, no bleeding in labor, and no hemorrhage with the delivery. Fetal death evidently

was the primary event, followed by thrombosis or agglutination of the vessels and placental separation without hemorrhage.

Duration of separation could not be known but life was not demonstrable two days before delivery.

CASE 8.—Mrs. M., white, aged thirty-eight years, para iii. Last menstruation was Nov. 14, 1934, quickening April 4, 1935, term date Aug. 21, 1935. Prenatal care was without incident, the urinalyses and blood pressure were normal, the last being 122/68. Fetal heart tones at the last visit were 136, and in R.L.Q.

Mrs. M. was admitted to the hospital at 3:30 A.M. July 9, 1935, in labor, having pains every three to five minutes, which lasted forty to fifty seconds. The interne on duty made his examination at 3:45 A.M. and reported the position obscured by a moderate polyhydramnios. Fetal heart tones were reported not heard. The patient was examined more carefully at 4:10 A.M. when the dilatation was between 7 and 8 cm. At this time a heart rate of 74 was observed and was assumed to be the mother's. Subsequent delivery of the baby proved, however, that this was the fetal heart tones, as the pulsation of the cord at delivery was at rate of 74, and auscultation over baby's precordium revealed a rate of 74. Reference then to the nurse's record showed mother's pulse on admission to have been 90, with other recorded rates of 92 and 84. At no time was the mother's pulse recorded as low as 74, until twenty-four hours after delivery. Palpation of the mother's pulse at time of listening for fetal heart tones would have eliminated this error of reporting them as absent.

Breech extraction was at 6:42 A.M. The baby was five to six weeks premature and weighed 5 pounds 3 ounces. It was partially asphyxiated, had a very extensive spina bifida, open beyond repair, and succumbed to its prematurity, asphyxia, and malformation within an hour after delivery. Autopsy showed numerous other anomalies.

The placenta, delivered immediately after the baby, showed the opening in the membranes sufficiently far from the placenta to rule out marginal, or low implantation. Old clots and discoloration of the maternal surface of the placenta indicated that this organ had been detached over three-fourths of its area for a considerable time previous to delivery. The uterus was never of ligneous hardness but did not completely relax between pains.

Known duration of ablatio was three hours forty-two minutes.

This series of cases gives me positive evidence of the value of the fetal heart tones in ablatio placentae from the standpoint of diagnosis, prognosis, and guidance in treatment. Often cases have a negative value, as well as positive. In this category it is well to cite two cases in which the constancy of the fetal heart rate proved the deciding factor in ruling out placental separation.

CASE 9.—Mrs. D., white, para ii, aged twenty-eight years, has a single prenatal record extending over a period of twelve months and eight days. The early part of this record discloses a history varying from spotty to free bleeding at frequent intervals. Subsequent history and examination led to the conclusion that spontaneous abortion occurred at about two to two and one-half months. Events that followed proved this patient to have become pregnant immediately after aborting. The first six months of this second pregnancy (her third) was rather free of any bleeding. The last trimester was productive of two hemorrhages varying from reported one-fourth to one-half cup volume. The fetal heart tones were taken at home and on subsequent frequent office visits in both instances of hemorrhage. They were found to be entirely uninfluenced in their rate by either hemorrhage, showing no interference, therefore, in the oxygen-carbon dioxide exchange between fetus and

mother. This ruled out placental separation and rectal examination failed to reveal a placental mass in the pelvis, which ruled out placenta previa. There was no cervical polyp or varix. The placenta, delivered at term June 9, 1935, showed no signs of even slight separation and no evidence of injury or accident to the marginal vein. The origin of hemorrhage, in this case, was undetermined.

CASE 10.—Mrs. W., white, aged thirty-three, para ii, gave a history of rather severe hemorrhage while walking about her home, a little before the seventh month. At this time her attending physician made a tentative diagnosis of placenta previa or possible ablatio placentae. The bleeding ceased in compliance with his order of complete rest in bed. There was no recurrence of bleeding. After freedom of hemorrhage for approximately three weeks, internal examination revealed the absence of any placental mass within reach of the examining fingers. The fetal heart tones at the time of hemorrhage and throughout subsequent prenatal visits were within the range of 136 to 140, this difference being only an amount that could be accounted for by variation in the count of one beat per fifteen seconds. The fetal heart tones and internal examination seemed, in this instance, to rule out both placental detachment and placentae previa.

Mrs. W. entered the hospital at 10:45 P.M. May 26, 1935, in labor without bleeding, blood pressure 110/88. The fetal heart tones were 136, position L.O.A., dilatation 1 to 2 cm., pains slight and at five- to ten-minute intervals. Labor progressed normally, dilatation being complete at 10:45 A.M., delivery at 11:44 A.M. The placenta was expelled at 11:49 A.M. There was no unusual bleeding in labor; the heart tones remained normal. The site of rupture of the membranes indicated that the placenta had been situated high in the uterus and gave no evidence of any separation. The perineum and vaginal mucosa were markedly varicosed. This condition, no doubt, was the source of the hemorrhage at seven months, at which time observation of the fetal heart tones relieved a tense situation.

In reviewing these cases it would seem that the greatest practical value in studying the significance of fetal heart tones would be derived by classifying them in accordance with their degree of separation. This classification must, of course, at first be arbitrary, but it would seem that there could hardly be a simpler scheme than that of using the fractional area basis of detachment as expressed in these case reports, to compare with the heart rate acceleration. Since both extreme and intermediate variables of rate and area separation are represented in these cases, they might be accepted as a standard of future investigation. These values were determined by steadfast watching of every phase of each individual case, together with positive determination of the degree of placental separation at delivery.

In this way it can be shown that a definite degree of placental separation is associated with a rather definite acceleration in the fetal heart rate and the following values obtained. Taking as a basis a normal case with average fetal heart tones of 136 to 140 and the placenta completely attached, the separating of one-fourth to one-third of the area would lead one to expect the fetal heart tones to be 160 to 170; while with one-half separation and fetal heart tones of 180 to 190, at which point, the time factor considered, the fetus passes from a compensation phase into a phase of asphyxia. When the fetal heart tones decrease with three-fourths separation of placenta from 90 to 70 fetal death will occur before, at, or immediately after complete detachment. This process may

TABLE I. TABULATION OF CASE REPORTS

CASE	AGE	PARA	HEM.	PAIN	TENDER- NESS	UTERINE FIRMNESS	F. H. T.		B. P.	PLAC. SEP.	DURATION OF PLAC. SEP.	BABY	
							PREG.	HOSP.				BORN	L—LIVED D—DIED
1-K	25	i	V.E.	0	+	SL.	140	160	116/70	3 1/2	3 hr. 58 min.	A	L
2-S	25	ii	V.E.	0	+	0	136	150	120/70	3 1/4	2 hr. 35 min.	A	L
3-B	33	ii	V.E.	0	+	SL.	136	162	118/70	3 1/2	3 hr.	A	L
4-D	30	ii	V.E.	0	+	SL.	136	170	98/54	1 1/2	3 hr. 30 min.	A	Premature D
5-S	36	i	V.E.	+	+	0	?	160 → 140	180/105	C	6 hr. 16 min.	S	—
6-A	25	i	V.E.	+	+	Lig.	?	0	?	C	3 1/2 hr.	S	—
7-O	36	ii	O. V.E.	0	0	0	144	0	110/70 to 160/80	C	?	S	—
8-M	38	iii	V.E.	0	+ SL.	SL.	136	74	160/80 122/68	3 1/4	3 hr. 42 min.	A	Asphyxia D
9	?	M	V.E.	0	+	SL.	?	160	?	?	?	A	Deformity L
10	?	M	V.E.	0	+	SL.	?	150	?	?	?	A	L
												70% A 30% S	50%

involve five minutes or five hours and will obviously present some variations, depending upon the elapsed time occupied by any phase along this uniform line of events.

For instance, one case had fetal heart rate of 70 with three-fourths of the placenta separated, while in another the heart tones were absent with the same degree of detachment, showing that, after all, there is a limit beyond which the fetal organism can no longer compensate for a given degree of placental detachment.

In this study we have watched the heart accelerate, and at delivery determined the area of placental detachment in order to form a logical association of these two phenomena. The practical application now fol-

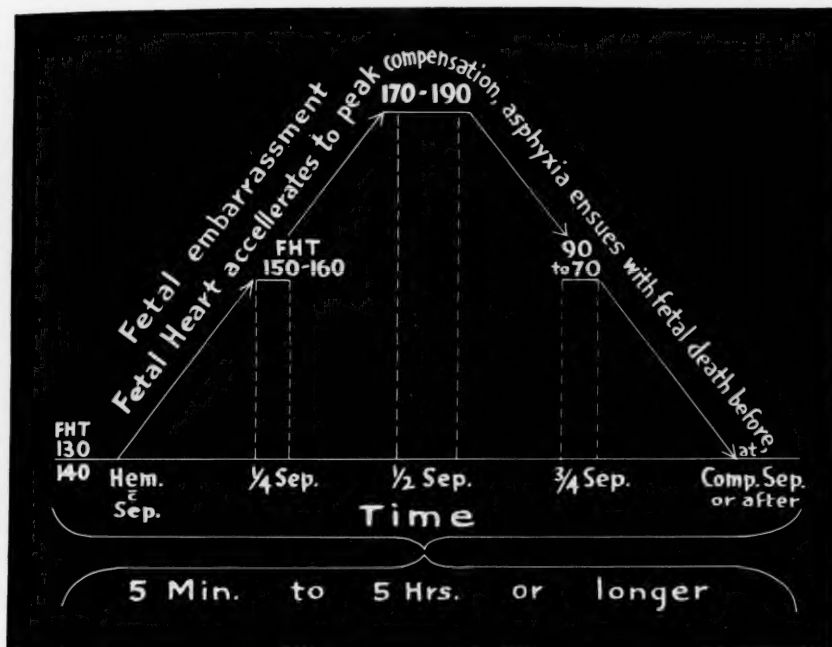


Fig. 1.

lows that with this basis one can observe the acceleration of the fetal heart rate and thereby arrive at a diagnosis of the approximate, and usually quite exact, area of placenta which has become separated. Such an evaluation renders the wide application of these figures obvious.

It must also be apparent that to secure all the information obtainable from variations in the fetal heart rate, especially in labor, the rate should be observed at definite and frequent time intervals. Such practice at fifteen- or even at thirty-minute intervals, would, in most instances, make evident the response of the fetal organism to the primary embarrasment of ablatio placentae before other signs of this complication are present, and also before this accident has reached a stage critical to mother or fetus.



Then, with an acceleration of the heart rate, instead of waiting for the appearance of external hemorrhage and instead of waiting for a ligneous hardness of the uterus, evidence of internal bleeding should be sought for as well as a failure of the uterus to relax between pains, and whether a tenderness at any circumscribed area of the uterus exists. By securing this earlier information it would be evident that, in by far the greater number of cases, *ablatio placentae* is not an abrupt process at all but insidious in its course and that it usually presents time for more adequate and satisfactory treatment than is usually given.

With an earnest effort toward earlier diagnosis of *ablatio placentae*, a conflict arises in our differential diagnosis of this condition from *placenta previa*, and some of the lines of difference between these two are erased. It is possible that we are even too familiar with the classical differential tables which inform us of the cessation of fetal movements in separation cases and no change in the previas, of the presence of fetal heart tones in *placenta previa* and their absence in *ablatio*.

After a study of these eight reported cases, together with two other patients who were observed and treated during the period covered by this paper, and a review of eight additional patients delivered by associates in attendance at Wesley Memorial Hospital, the writer would be inclined to disagree with certain other features characterizing the aforesaid differential tables. When *ablatio placentae* is recognized early, and the prerequisite of this is that the baby be watched as closely as the mother, it would appear that the onset is not as stormy nor as sudden as usually reported. None of the eight reported cases or the other two cases mentioned could be said really to have had a stormy onset.

Only one of these cases was allowed to go on to a development of a ligneous uterus. Of the cases reviewed at Wesley Hospital only three could be said to have this degree of uterine hardness. The hemorrhage naturally is visible externally at the onset of *placenta previa* and usually not in *ablatio*, although in the latter, blood would appear externally early enough to be of diagnostic aid in a reasonable number of cases. Pain has developed in these cases only on retention of a clot between the placenta and the uterus and usually in the latter part of the picture. Cases 1, 2, 3, 4, 7, and 8 had no pain, so that in these cases we were confronted with a painless and improperly called causeless hemorrhage, which is usually thought of as being characteristic only of *placenta previa*. The patient in Case 5 had pain attributable to separation throughout the last half of her labor. Patient in Case 6 had pain attributable to separation, the onset of the pain being three and one-half hours after the first hemorrhage and of about that duration from onset to operation.

During the three-year period which covers this series, two cases of *placenta previa* have come to attention where pain was a complaint of importance and in one the uterus failed to relax between labor pains. In this given interval were two cases of *placenta previa* where the pa-

tients entered the hospital within one hour or less after the initial hemorrhage and in which fetal heart tones were gone at the time of admission. Two patients came under observation, where on entrance to the hospital, with placenta previa totalis, sufficient separation had occurred that the fetal heart rate in the two was between 170 and 190, and in one, upon delivery of the placenta, the area of separation was estimated at slightly over one-half of the total placental area. In the other case no effort was made to identify the degree of separation.

It would seem, therefore, with the overlapping of signs and with the overlapping of symptoms in these two sister conditions, that in ablatio placentae we should start teaching the recognition of the condition on the basis of earlier findings. It would seem, further, that in recognition of these earlier findings, there is not such a wide differentiation as we are used to considering, and that one may have to rely upon the earlier bleeding of placenta previa and upon the finding, rectally or vaginally, of the placental mass, and its absence in ablatio.

It would not seem so far amiss to treat these two conditions from the standpoint of the teacher and writer, as conditions of placental separation, because after all they both come to this end eventually. It is true that the causes are anatomical in the one instance and may be intrinsic or extraneous in the other. Cognizance is also taken of the fact that in one the pregnancy started with an abnormally situated placenta, while in the other it began with a normally situated placenta. From the standpoint of signs and symptoms these conditions tie up, inasmuch as their symptom complex is almost wholly the *effect* of separation.

#### PROGNOSIS

In the words of Holmes,<sup>10</sup> "Ablatio is one of the cataclysms of the child-bearing woman. Probably more is gained by a prompt diagnosis and aggressive treatment than is lost by the severity of symptoms. Procrastination is largely responsible for the maternal and fetal mortality." Various authors cite a maternal mortality which ranges from about 13 up to 50 per cent, with a fetal mortality ranging from 20 to 85 per cent. In the 8 cases reported herein and the 2, previously referred to, and in the 8 cases taken from the histories of the last 3,072 deliveries at Wesley Memorial Hospital, we have a total of 18 cases without a maternal death.

My 10 cases were distributed thus: 5 at Wesley Memorial Hospital and 5 at 4 other hospitals. In these 10 cases 7 babies were delivered alive; 3 were stillborn. Of those born alive, 5 lived, 1 died of prematurity, 1 died of asphyxia and malformations; of those born dead 1 was known to have died of toxemia before separation. The second died of a separation due to a diabetic toxemia, and a third died in utero as a result of the separation, which likewise was of toxic origin. The total infant mortality for this series is 50 per cent, the corrected mortality 30 per cent. So that when one considers that, inasmuch as most pla-

cental separations are of toxic origin, the fetal mortality must of necessity remain high. In analyzing this mortality we find that if they do not die directly of the ablatio, they succumb to the toxemia first and detachment follows, or in the one case the ablatio is productive of a premature delivery and the baby dies of the prematurity, or is indirectly a victim of the ablatio.

It is not the purpose of this paper to enter upon a discussion of treatment, further than to offer a plea of early intervention. One author advises that we must sit by the patient, watching every change; that is just what should not be done. An early diagnosis is imperative. This may be arrived at best not by simply watching the patient, but by directing earnest attention toward the fetal condition, and upon arriving at a positive diagnosis of ablatio placentae, unless delivery is imminent, resorting to immediate action. If action is taken upon the condition of the fetal heart tones and not after they are gone, if action is not deferred until the uterus is ligneous, if efforts are directed to saving the baby, the efforts in behalf of the mother will be more effectual. This is true since the earliest sign that can be observed referable to the fetus is an acceleration in fetal heart tones, which will come more often than not before the evidence of hemorrhage, and this, in turn, will be a true indication of the progress of the condition.

What action we will take must naturally be governed by the progress of labor, the condition of the cervix, and the descent of the head, but all of these in consideration of the condition of the baby as well as the mother, for anything directed toward saving the baby will be initiated earlier than if our symptom complex is based entirely upon maternal signs and symptoms.

#### SUMMARY

1. Placental separation disturbs the oxygen-carbon dioxide balance of the fetus.
2. This disturbed oxygen-carbon dioxide exchange accelerates the fetal heart rate.
3. The acceleration of the fetal heart rate bears a definite relationship to the area of placental detachment.
4. The fetal response is characterized by a compensatory and an asphyxia phase.
5. This response of the fetal organism presents signs which are invaluable aids in diagnosis, prognosis and treatment.
6. Earlier diagnosis narrows the differential value between ablatio placentae and placenta previa.
7. Prognosis rests on a more sound basis.
8. Treatment is facilitated by early recognition.

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30 NORTH MICHIGAN AVENUE

NOTE.—Since presenting this paper, a case has come to our attention at Wesley Memorial Hospital, in which this relation of fetal heart rate to placental separation enabled me to diagnose biovular twins before delivery.

The patient was admitted because of hemorrhage, twins were diagnosed on admission and observation of the fetal heart rates showed that the heart rate of one baby remained constant while that of the other progressively increased. The bleeding continued. It was reasoned that there must be two placentas, one of which was separating, while the other remained normally attached. Had both babies been attached to the same placenta, both heart rates would have accelerated in response to the separation. The increasing rate continued to 190, when section was performed, and two living babies were delivered. Both babies and mother survived.

#### DISCUSSION

DR. RUDOLPH W. HOLMES.—There have been a number of factors which have contributed to the common failure in recognition of this condition, from the beginning of time to the present day. In the order of their development they are as follows. First: Madame Boivin, one of the keenest minds in obstetric history, declared that the pregnant uterus was full, and what was full could not be more filled. She and her disciples failed to appreciate that the uterus was an elastic, distensible organ. Second: Rigby, about 1775, coined the term "accidental hemorrhage" to fit his concept that it was incident to extraneous circumstances. Third: The term abruptio placentae has been associated with the erroneous notion that the onset of ablatio placentae was always violent, sudden, explosive and such an onset is actually exceptional. Fourth: The pain is not always severe at the onset but may be extremely slight. Fifth: The *ligneous hardness*, so much emphasized, is actually mentioned in but 18 to 20 per cent of recorded cases. Dr. Richardson's contribution is of special use during the early period of the complication not only as an indicator of the fetal jeopardy and degree of separation, but also in differential diagnosis. Symptoms which are associated with other bodily dysfunctions, cerebral anemia, cardiac disease, faintness, etc., will produce no alteration of the fetal heart rate or its intensity. On the contrary, placental separation will immediately affect the character of the fetal heart.

The fetal heart acceleration, with eventual slowing due to asphyxia, is extremely frequent. At times, however, the uterine surface of the placenta will be torn during the act of separation, thus opening the fetal circulation. The resulting fetal hemorrhage will contribute to the heart acceleration, and will antagonize the slowing incident to asphyxia.

The leucocytic count is of considerable value, for in many instances of ablatio placentae the white count will be increased to 20,000 or even 40,000. Whether this

leucocytosis is limited to Couvellaire's uteroplacental apoplexy, or is common to all forms of ablatio placentae has yet to be proved.

DR. LOUIS RUDOLPH.—On the basis of the underlying physiologic changes, I have clinically divided ablatio placentae into the contractive and the retractive types. The contractive type is characterized by sudden abdominal pain, shock, anemia, and a ligneous uterus. The retractive type, which appears to be that of six cases in Dr. Richardson's report, has a much less acute onset, some abdominal pain, slight anemia, no shock, and a firm uterus that has a doughy consistency.

What is the physiologic explanation of the two types? In the contractive type the uterus is distended and tetanic, and no retraction of the muscle fibers related to the placental site, particularly the orbicular muscles of Ruysch, occurs. In the retractive type there is marked retraction of the musculature of the upper uterine segment and particularly the placental site or of the upper and the lower uterine segments with an arrest of the intrauterine hemorrhage.

The contractive type is safer to treat by immediate cesarean section in order to stop the hemorrhage. The retractive type can be treated in a conservative manner, because on account of the early retraction of the placental site further hemorrhage in the majority of instances will not recur.

DR. MARK GOLDSTINE.—If we follow Dr. Richardson's method carefully, the treatment of these cases should be much safer. We will save a good many more babies by watching the heart tones carefully and may prevent a rare case of rupture of the uterus.

DR. FREDERICK FALLS.—There is a difference between the case that is completely detached and the one in which the placenta is separating. Once the placenta is one-half or three-fourths detached, there is no chance for the fetus and in these cases we can turn our undivided attention to the mother. When a placenta begins to separate, no one can say how soon the separation will complete itself. What one does know is that further separation will mean death to the baby at least, and great increase in danger to the mother.

In most of these cases when the heart tones are becoming rapid or slowing to the asphyxia stage, the thing to do is to open the uterus from above and deliver the baby. Then observe the uterus and see whether there is an apoplexy at the placental site, or whether it contracts satisfactorily. If it does not contract and shows a tendency to postpartum hemorrhage, take it out. If it reacts favorably close it and leave it in.

In my clinic when a patient comes in with an ablatio placentae, the operating room is prepared as soon as the diagnosis is made. We do not always use it, but we feel that the only safe position to be in, in the presence of a uterine apoplexy, is in the abdomen where clamps can be placed on the uterine vessels if necessary.

DR. RICHARDSON (closing).—When there was early bleeding to attract our attention the fetal heart rate was constantly watched from the first sign of ablatio until the time of delivery. Early observation of the fetal heart tones in general cases did occasionally reward us by disclosing an acceleration. Whenever this occurs, one should look for internal bleeding, if external bleeding has not occurred. Every acceleration of fetal heart tones should arouse suspicion and lead us to seek other signs to confirm or rule out ablatio.

It is unfortunate that placenta previa and ablatio placentae are considered to be so different. In two cases of placenta previa which came in during the period of this investigation, the primary hemorrhage was so severe that the babies were dead on admission to the hospital, due to the amount of placental separation. In one of these conditions we have an abnormally implanted placenta and in the other a normal, but in neither are there symptoms until you have placental separation and hemorrhage. In both you may get acceleration of the fetal heart tones and in both fetal death.



## SPONTANEOUS RUPTURE OF THE MEMBRANES BEFORE THE ONSET OF LABOR\*

### A REPORT OF 425 CASES

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**D**URING the six-year period from Jan. 1, 1929 to Dec. 31, 1934, there were 8,601 deliveries on the Obstetrical Service of the University of Maryland School of Medicine. Of this number, 7,045 were delivered in the home and 1,556 in the University Hospital. A number of patients referred to the hospital for delivery by other clinics and private physicians are not included in this study. These patients were practically all pathologic cases selected from the total number of cases attended by the referring clinic or physician, and it was felt that, if they were included, inaccurate conclusions would be drawn, since the normal cases from this group were not available for study. It was impossible to determine the time of rupture of the membranes in 2,132 cases, and in 57 cases the patient did not know when her pains began. The membranes ruptured and the pains began simultaneously in 140 cases. There were 304 abortions which are included in the total number of patients delivered but not included in this study because of insufficient data. The majority of the patients, who could not be included in the study because the time of rupture of the membranes or time of the onset of labor was not known, were delivered before an attendant reached the patient's home. The same is true of the abortion cases. The total number of cases discarded from the study is 2,633 or 30.61 per cent of the entire number.

Of the 5,968 remaining cases, 425 patients or 7.12 per cent had spontaneously ruptured their membranes before the onset of labor. The following study is an analysis of these 425 cases from 15 angles, namely: parity, age, race, latent period, duration of labor, relation of baby's weight to latent period, relation of baby's weight to duration of labor, relation of abnormal presentations to latent period and duration of labor, methods of delivery, cause of rupture, complications, maternal morbidity, maternal mortality, condition of babies at birth, and infant mortality during the first two weeks of life.

*Parity.*—Ninety-nine cases or 23.35 per cent were primigravidas and 326 or 76.65 per cent were multigravidas. These figures are very close to the ones for the entire number of patients delivered during this time, namely, 27.52 per cent primigravidas and 72.48 per cent multigravidas. As is to be expected the number of

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cases reported decreases as the parity increases, because there were fewer patients cared for who were pregnant for the tenth and eleventh times than those who were pregnant for the second and third times.

*Age.*—In the primigravida group, 51.51 per cent fell between the ages of fifteen and eighteen years. The youngest was fourteen years (2 cases) and the oldest forty-one years (1 case). In the multigravidas 36.8 per cent were between the ages of twenty and twenty-five years with an additional 22.08 per cent between the ages of thirty-two and thirty-five years. The youngest was seventeen years (6 cases) and the oldest forty-eight years (1 case).

*Race.*—There were 135 or 31.77 per cent white patients and 290 or 68.23 per cent colored patients. The total number of patients cared for during the period was 16 per cent white and 84 per cent colored. These figures seem to indicate that more white women had rupture of the membranes before the onset of labor than did colored women, but the white women are, as a rule, more intelligent and observant than the colored women, and for this reason a higher percentage of white patients may have given more complete and accurate information.

*Latent Period.*—There were 89 cases or 89.89 per cent of the primigravidas who had latent periods of 24 hours or less, the average period being 4.69 hours with the shortest, 0.5 hour or less for 29 cases and the longest, 23 hours for 1 case. The other 10 cases or 10.11 per cent had latent periods of 25 hours or more, the average period being 88.7 hours with the shortest 25 hours for 2 cases and the longest 336 hours for 1 case. The average latent period for all primigravidas was 13.17 hours.

Of the multigravidas 258 cases or 79.14 per cent had latent periods of 24 hours or less, the average period being 6.43 hours, with the shortest 0.5 hour or less for 38 cases and the longest 24 hours for 9 cases. Sixty-eight cases or 20.86 per cent had latent periods of 25 hours or more, the average period being 78.02 hours, with the shortest 25 hours for 1 case and the longest 672 hours for 1 case. The average latent period for all multigravidas was 21.41 hours (Table I).

Table I shows the average latent period for all cases in relation to the number of pregnancies. From a study of this table it seems that the latent periods are relatively long but fairly constant until the fifteenth pregnancy, when there is a marked sudden shortening. However, these for the most part are based upon one or two cases only, and it is impossible to draw conclusions from such a small number.

TABLE I. AVERAGE LATENT PERIOD FOR ALL CASES IN RELATION TO THE NUMBER OF PREGNANCIES

NO. OF PREGNANCIES	AVERAGE LATENT PERIOD HOURS	NO. OF PREGNANCIES	AVERAGE LATENT PERIOD HOURS
1	13.17	10	18.20
2	27.98	11	18.60
3	19.77	12	22.00
4	29.89	13	11.29
5	19.64	14	16.00
6	17.52	15	3.50
7	6.21	16	6.00
8	23.47	21	10.00
9	19.50		

*Duration of Labor.*—Ninety-two cases or 92.92 per cent of the primigravidas had labors of 24 hours' or less duration, the average period being 8.89 hours, with the shortest 2 hours for 5 cases and the longest 24 hours for 1 case. Seven cases or 7.08 per cent had labors of 25 hours or more, the average period being 36 hours, with the shortest 25 hours for 1 case and the longest 79 hours for 1 case. The average duration of labor for all primigravidas was 10.8 hours as compared with the accepted normal of 18 hours.

There were 316 cases or 96.93 per cent of the multigravidas who had labors of 24 hours or less duration, the average period being 7.3 hours, with the shortest 1 hour for 3 cases and the longest 23 hours for 2 cases. Ten cases or 7.07 per cent had labors of 25 hours' or more duration, the average period being 33.4 hours, with the shortest 26 hours for 1 case and the longest 50 hours for 1 case. The average duration of labor for all multigravidas was 8.1 hours as compared with the accepted normal of 12 hours (Table II).

TABLE II. AVERAGE DURATION OF LABOR IN RELATION TO THE NUMBER OF PREGNANCIES

NO. OF PREGNANCIES	AVERAGE LATENT PERIOD HOURS	NO. OF PREGNANCIES	AVERAGE LATENT PERIOD HOURS
1	10.80	10	18.00
2	7.94	11	8.00
3	6.93	12	6.00
4	8.00	13	10.14
5	8.12	14	6.00
6	8.10	15	14.00
7	7.85	16	4.00
8	8.00	21	3.00
9	16.30		

The figures in Table II indicate that one may expect the length of labor in the ninth and tenth pregnancies to be more than twice that in any other except in the thirteenth and fifteenth pregnancies where it is only slightly longer and in the sixteenth and twenty-first where it is more than  $4\frac{1}{2}$  and 6 times longer. However, it must be noted that there were so few patients who had had more than 10 pregnancies that no conclusions can be drawn from these figures.

*Relation of Baby's Weight to the Latent Period.*—No relation of the weight of the baby to the latent period can be shown. For example, in the secundigravida group patients with 1-pound babies had an average latent period of 48 hours, with 4-pound babies almost no latent period, and with  $4\frac{1}{2}$ -pound babies 31 hours. The same was found to be true in all of the other groups.

*Relation of Baby's Weight to the Duration of Labor.*—The only relation of the weight of the baby to the duration of labor that can be demonstrated is the one found in any group of cases; that is, large babies are frequently associated with long labors.

*Relation of Abnormal Presentations to Latent Period, Duration of Labor, and Baby's Weight.*—(Table III.) The average latent period for the abnormal presentation group of primigravidas was 3.5 hours as compared with 13.17 hours for the total number. Because of the abnormal presentations all deliveries were completed artificially and thus the duration of labor was shortened to a more or less degree. With one exception, the longest labors were only slightly more than the average for the primigravidas for the entire series.

Table IV for multigravidas is condensed and only averages are given to save space. However, it does show, with one exception, that the latent periods are less than for the multigravidas as a whole. The entire group had an average latent period of 21.41 hours while the longest time in the abnormal presentation series was 21.25 hours and the shortest 0.5 hour. As in the primigravidas, the duration of labor was shortened by operative deliveries. The averages in all cases, with two exceptions, compare favorably with the duration of labor for the entire group of multigravidas, that is, 8.1 hours. The one exception in the latent period was a compound presentation of head and elbow with a latent period of 120 hours. The duration of labor in this case was also prolonged, 18.5 hours. In the group of four transverse presentations there were two that had been unrecognized, and the patients

were allowed to continue in labor for some time after complete dilatation of the cervix, thus increasing the average for the group.

The size of the baby apparently had no relation to the latent period in either primigravidas or multigravidas, but as is to be expected the duration of labor does seem to increase as the weight of the baby increases.

TABLE III. RELATION OF ABNORMAL PRESENTATION TO BABY'S WEIGHT, LATENT PERIOD, AND DURATION OF LABOR. PRIMIGRAVIDAS

BABY'S WEIGHT POUNDS	POSITION	DURATION OF LABOR HOURS	LATENT PERIOD HOURS
4½	R.S.A.	2.00	7.75
5½	R.S.A.	4.50	0.50
6¼	R.O.P.	17.00	0.50
6½	L.S.A.	4.75	0.25
6½	R.O.P.	10.50	11.00
6½	L.O.P.	12.00	7.00
7¼	R.O.P.	10.75	2.50
8¼	L.S.A.	10.00	0.25

TABLE IV. RELATION OF ABNORMAL PRESENTATION TO BABY'S WEIGHT, LATENT PERIOD, AND DURATION OF LABOR. MULTIGRAVIDAS

BABY'S AVERAGE WEIGHT POUNDS	NO. OF CASES	POSITION OR PRESENTA- TION	DURATION OF LABOR HOURS	LATENT PERIOD HOURS
5½	1	Compound head-elbow	18.50	120.00
5¾	15	*Breech	10.25	18.00
6	4	L.O.P.	8.25	11.50
6½	12	R.O.P.	9.50	21.25
6¾	1	L.M.A.	4.50	0.50
8¼	4	†Transverse	15.50	8.50

\*Two cases were frank breech. Others not stated.

†Actual position not stated.

*Methods of Delivery.*—There were 390 patients or 91.76 per cent delivered normally. There were no operative deliveries among the primigravidas that can be said to have been due to the early rupture of the bag of waters. Two operative deliveries of multigravidas were probably called for because of early rupture of the membranes. One was a case of prolapsed cord in a gravida ix delivered by version and breech extraction. The second was a neglected transverse presentation in a gravida vii delivered by decapitation. Table V shows the method of delivery for all patients with the indications for operative deliveries. Three deliveries are not noted in the table, namely, 2 cesarean sections for cephalopelvic disproportion and 1 decapitation for a neglected transverse presentation.

*Possible Causes of Rupture.*—A careful study was made to determine if possible any cause or causes for the rupture of the membranes before the onset of labor. There were 129 patients or 30.35 per cent who had some condition that may have caused the early rupture. However, there seems to be such a variety of causes that it is impossible to say whether one condition is more likely to cause the rupture than some other condition. From Table VI it would seem that toxemias and syphilis are in the lead, but so many more patients, among the entire number cared for during the period that this study was made, had one or the other complication or both and still began labor with unruptured membranes that one hesitates to draw such conclusions. Perhaps we may say that abnormal presentations such as breech and transverse or overdistention of the uterus, as with twins, may have had some effect upon the early rupturing of the membranes. The fact that there were 13 sets of twins in the group would seem to confirm this impression; however, it must

TABLE V. METHODS OF DELIVERY

GRAVIDA	NORMAL LOW AND MIDFORCEPS		BREECH EXTRACTION	VERSION AND BREECH EXTRACTION
1	75	Low 2 Uterine inertia 1 Fetal distress 1 Mid 2 Prolonged labor 1 R.O.P. 1 Elective 15	4 Breech pres.	0
2	67	Low 1 R.O.P. Mid 1 R.O.P. Elective 1	3 Breech pres.	0
3	64	0	1 Breech pres.	1 2nd twin trans.
4	43	Low 1 maternal distress	1 Breech pres.	2 Trans. pres. 2
5	29	0	1 Breech pres.	0
6	37	0	1 Breech pres.	0
7	24	0	3 Breech pres.	0
8	20	0	1 Breech pres.	0
9	8	0	1 Mat. distress	1 Prolapsed cord
10	5	0	0	0
11	5	0	0	0
12	2	0	0	0
13	6	0	0	1 Trans. pres.
14	1	0	0	0
15	2	0	0	0
16	1	0	0	0
21	1	0	0	0

be noted that there is not one case of hydramnios in the entire series. Bicornuate and prolapsed uteri are rare enough complications of pregnancy to be considered as fairly definite causes.

*Complications.*—Only those complications which might have been due to the premature rupture of the membranes are listed in Table VII. The cases of infection will be discussed under morbidity. It is interesting to note that there is only one

TABLE VI. POSSIBLE CAUSES OF RUPTURE

POSSIBLE CAUSES OF RUPTURE	NO. OF CASES
Toxemias	52
Syphilis	29
Breech presentation	16
Twins	13 sets
Transverse presentation	4
Abruptio placentae	4
Low implantation of placenta	2
Prolapsed uterus	2
Syphilis and toxemia	2
Compound presentation	1
Face presentation	1
Placenta previa	1
Bicornuate uterus	1
Breech presentation, syphilis, and toxemia	1
	129



case each of prolapsed cord and arm, in spite of the fact that authorities say that the cord is very likely to become prolapsed if the membranes rupture before the presenting part has descended into the pelvis. Two patients were noted as having adherent placentas and in one case where the membranes had been ruptured for several weeks the placenta and membranes were described as being shrunken, dry, and leathery. The case of ruptured uterus was in a transverse presentation and presumably occurred because the amniotic fluid had drained away. The duration of labor in this patient was twenty-five hours, and it is reasonable to suppose that the amniotic fluid would have drained away before the time of delivery whether the membranes ruptured before or shortly after the onset of labor.

TABLE VII. COMPLICATIONS

COMPLICATIONS	NO. OF CASES
Infection	11
Uterine inertia	3
Adherent placenta	2
Prolapsed cord	1
Prolapsed arm	1
Ruptured uterus	1
Dry and leathery placenta and membranes	1

*Morbidity.*—Table VIII gives the corrected morbidity for the group. Those patients with definite intercurrent infections such as pneumonia, pyelitis, etc., have been excluded. A temperature of 100.4° for two consecutive days was interpreted as morbidity. Temperatures were taken twice daily on those patients delivered at home. It is quite probable that the morbidity rate would be higher if all temperatures had been taken every four hours.

There were 11 patients or 2.58 per cent in this group. Of these, 6 patients had operative deliveries which may have been the cause of the infections. Of the 5 normal deliveries, 1 patient had preeclamptic toxemia and 1 had a low implantation of the placenta. From a study of the table it appears that rupture of the membranes alone is not sufficient to cause an elevation of temperature. All patients except 1 with latent periods of 100 to 300 hours had perfectly normal puerperiums.

TABLE VIII. CORRECTED MORBIDITY IN RELATION TO LATENT PERIOD, DURATION OF LABOR AND METHOD OF DELIVERY

LATENT PERIOD HOURS	DURATION OF LABOR HOURS	METHOD OF DELIVERY	HIGHEST TEMPERATURE
1/4	3	Cesarean section	103.2°
2	7 1/2	Normal	103.0°
4 1/2	3 1/4	Normal	101.8°
5	1/4	Cesarean section	103.1°
11 1/2	17 1/2	Normal	101.2°
19	6	Normal	103.3°
24	24	Decapitation	102.7°
48	18 1/2	Manual rotation of head, midforceps	102.1°
60	27 1/2	Midforceps	101.4°
72	17 1/2	Normal	101.1°
120	18 1/2	Version and breech extraction	102.4°

*Maternal Mortality.*—The maternal mortality as far as the obstetric service is concerned was zero. There was one patient with a latent period of thirty-six hours, duration of labor four hours, and a normal delivery, who developed bronchopneumonia and died on the medical service. This gives an uncorrected mortality for the series of 0.002 per cent.

*Condition of Babies at Birth.*—There were 438 babies born to 425 mothers (13 sets of twins). Of this number 402 or 91.56 per cent were full-term living chil-

dren; 12 sets of twins were in this group. There were 23 full-term dead babies, but only two of these stillbirths could be said with any certainty to be due to the premature rupture of the membranes, one because of a prolapsed cord and the other a transverse presentation delivered by decapitation. Of the 12 premature living babies one set of twins may have been born prematurely because overdilatation of the uterus caused the rupture of the membranes before term. There was only one premature dead baby which occurred in a case of prolapsed uterus.

*Infant Mortality.*—Thirteen babies or 0.03 per cent died during the first two weeks of life. The cause of death in 12 cases was given as prematurity and in 1 case the cause was not stated.

#### SUMMARY

1. In this series approximately 7 per cent of the patients had premature rupture of the membranes.
2. Possibly early rupture is more frequent among white than colored women.
3. The average latent period for primigravidas was 13.17 hours and for multigravidas 21.41 hours.
4. Parity apparently has no effect upon the frequency of rupture.
5. Age does not appear to play any part in the frequency of occurrence.
6. The average duration of labor is less for all patients than that generally accepted as normal.
7. The duration of labor in relation to the number of pregnancies remains almost constant except in the ninth, tenth, thirteenth, and fifteenth pregnancies, where it is approximately doubled, and in the sixteenth and twenty-first pregnancies, where it is only one-half as long.
8. There is no relation of the baby's weight to the latent period.
9. There is no relation of the baby's weight to the duration of labor that can be demonstrated to be due to the premature rupture of the membranes.
10. There is no lengthening of the latent period or the duration of labor in the abnormal presentation group.
11. The size of the baby has no relation to the latent period or the duration of labor in the abnormal presentation group.
12. Operative deliveries were not increased.
13. Toxemias and syphilis appear to cause rupture of the membranes before the onset of labor. Abnormal presentations may play some part. Twin pregnancy seems to cause early rupture of the membranes.
14. Complications are rare. The most common is infection.
15. Corrected morbidity was 0.025 per cent.
16. Corrected maternal mortality was zero.
17. There were 91.56 per cent of the babies who were born alive at full term. Only 2 dead babies can definitely be said to be the result of early rupture of the membranes, and none dying within the first two weeks of life can be attributed to this cause.

I wish to express my sincere appreciation to Dr. Louis H. Douglass for his assistance in the preparation of this paper.

## CESAREAN SECTION IN DYSTOCIA

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**I**N PRESENTING this series of twelve cases of dystocia with dead fetus, I have divided them into two groups of six cases each.

I. In the first group there are those cases in which the presenting part has been well engaged or could be easily immobilized by an assistant, and where there has been no dangerous thinning of the lower uterine segment, marked ascent of the contraction ring, or any spastic condition of the uterus which would interfere with reduction of the size of the presenting part.

In this group there are 6 cases. There were 2 decapitations for neglected shoulder presentation, and 4 cases of craniotomy for disproportion. All 6 mothers made an uneventful recovery.

II. The second group is the one of special interest in this series of cases. Here there is no engagement of the presenting part, and it is very difficult for an assistant to immobilize it. There is marked ascent of the contraction ring and a dangerous thinning of the lower uterine segment or a spastic uterine contraction around the fetal parts.

To do a crushing operation or a reduction in the first group is relatively easy and, of course, there should be no maternal mortality directly attributable to the procedure. The second group presents a different picture. I have found it extremely difficult to reduce the size of the presenting part in this class, and the results following the attempt were so disastrous that a better solution of the problem was sought. The last 4 patients were delivered by the abdominal route, followed by hysterectomy and drainage.

This is an operation that can be performed in thirty minutes, during which time steps can be taken to overcome the condition of shock or collapse from which these patients suffer. This treatment can be carried out while the surgeon is operating, including the use of saline solution, either under the skin or intravenously, or by whatever other means one has at hand. In a few moments also the vessels that carry the blood supply can be clamped or ligated, and the source of danger from hemorrhage is overcome.

Contrast this with the long-drawn-out, destructive operation where there is more or less hemorrhage and shock to the patient throughout the entire procedure. Only recently one of the most prominent obstetricians of the country had to be carried from the delivery room, physically exhausted, after performing one of these difficult destructive operations, with delivery by the vaginal route.

The criticism may be made that we sterilize, thus preventing any further chance of childbearing under more favorable conditions. While we grant there is great force in this argument, we cannot agree that the operation should be avoided entirely on this account, for even the destructive operations with vaginal delivery may cause sterility, either from infection or the secondary operations needed to correct the resulting injuries. The decision of the method to be used should be left to the patient or her family after proper explanation has been made of the advantages and disadvantages of each procedure.

The employment of the low cesarean section in these cases may be advocated. This operation has a great value in obstetrics, and in suitable cases there can be no valid argument against its use. However, is it justifiable to leave in situ a uterus that is in all probability infected? The following are illustrations of some complications of emergency, referred obstetric cases:

In one instance, the medical attendants, relieving each other when tired, had taken several hours in futile efforts to deliver the fetus by forceps and version. In another instance the doctor spent several hours trying to anesthetize and deliver the patient by himself, alternating the use of his hands for anesthetization and his attempts at delivery. Several other cases gave a similar history of extreme probability of infection by the various maneuvers to deliver the patient. To operate by the abdominal route and leave the uterus behind, one has to disregard the conception of infection entirely. We believe operations such as cervical or low cesarean section should be limited to those cases in which the infection is only potential and not probable.

The operation of embryotomy and delivery by natural passages is not without considerable mortality, as can be seen from the following statistics: Kerr reports 10 per cent; Perry, 38 per cent; Gussman, 6 per cent; Merryweather, 8 per cent; and Shauta, 6 per cent.

In deciding upon the type of operation to be performed in any surgical emergency, one should be guided first, by the immediate operative mortality; second, by the morbidity; and third, by the probable end-result as to health and comfort. In addition in obstetric operations the possibility of future childbearing is an important factor. The extent of the procedure should in itself play no part in the decision, since, as J. Whitridge Williams once said, "What appears to be great radicalism, may prove to be the utmost conservatism."

In the Proceedings of the Royal College of Surgeons in London there is an account of a meeting held by the London Obstetrical Society in 1892 devoted solely to craniotomy. Dr. Champney, in the discussion of the merits and dangers of the operation, claimed that intrauterine craniotomy was the most dangerous of all obstetric operations. It was pointed out that these dangers were due, first, to the previous futile efforts at delivery, and second, to the great difficulty in its performance. Dr. Champney reported that of 75 patients so treated in Guy's Hospital, 4 deaths resulted from the operation, 2 deaths from rupture of the uterus, 1 death from rupture of the rectum, and 1 death from peritonitis. In a report of 106 patients treated in the Queen Charlotte Hospital, there were 9 deaths. B. C. Hirst,

in 1888, reported one death from hemorrhage. Philips, in the *British Medical Journal* (1889), reported 16 cases with no deaths, but these were not of the difficult type under discussion. While he had not performed the operation himself, Philips thought that section might be advisable under certain circumstances.

In cases of dystocia which have been neglected and poorly managed, we have performed cesarean section with hysterectomy and drainage in two types of cases, which we have designated as the "frozen" and the "balloon." In the "frozen" type, one is unable to pass one's hand any distance into the uterine cavity, because of obstruction from the contraction ring. The fetus and the uterus seem to be glued together. On insertion of the hand into the "balloon" type, there seems to be an absence of uterine walls, because of the great dilatation of the organ. One is startled by the distinctness with which one can palpate the abdominal organs. Of my 6 cases, one (Case 3) was of the "balloon" type, and the other 5 were of the "frozen" type. In the former, the shoulder of the fetus came through the uterus when the counterpressure of the abdominal wall was removed by the incision.

#### CASE REPORTS

CASE 1.—Mrs. K., a primipara, was admitted in 1915 to the hospital in active labor, with the history of the membranes having ruptured the day before. Her temperature was 101°, pulse 130. An abdominal examination showed a vertex presentation in an L.O.P. position, with the head floating. Fetal heart sounds were not heard. On vaginal examination the cervix was found to be about one-half dilated and the uterus tightly contracted about the fetus. It was decided that, owing to the condition of the mother and the presence of a dead fetus, a craniotomy would serve the best interests of the mother. This was attempted, but due to the difficulty of immobilizing the head, the operation was a long and tedious one with free bleeding. With continued manipulations there resulted a ruptured uterus, hemorrhage, and death of the patient on the table.

CASE 2.—Mrs. A. K., a white American-born primipara, aged twenty-six, was admitted May 11, 1917. An attempt had been made at delivery at home with the use of high forceps. The temperature was 98.6°, and the pulse 130. On physical examination the patient was found to be in a state of shock. She had a contracted pelvis with an unengaged head, and there were no fetal heart sounds. The cervix was completely dilated, the membranes ruptured, the vertex presenting. A version was done, but the head could not be pulled through. The fetus was therefore decapitated, and the head was crushed and delivered with forceps. The patient sustained an extensive tear, and on the tenth day after delivery a vesicovaginal fistula developed. This fistula on account of the late appearance was ascribable to a pressure necrosis and not to an instrumental injury at the time of delivery. After three unsuccessful attempts by several members of the staff to repair this fistula, the patient was finally made comfortable by a colpocleisis performed by William E. Parke. The lack of success in the classical procedure was due to the fact that the vesical sphincter was involved in the sloughing. A puerperal septicemia occurred, thereby slowing the convalescence. The patient was discharged on July 29, 1917, the seventy-ninth day after admission. The last report concerning this patient was in 1930, at which time she was in good general health, and retained urine in the rectum for two to three hours.



With these two disasters we were led to attempt another method of handling such cases and have adopted the abdominal route, with cesarean section, hysterectomy, and drainage. We feel it is far preferable from the results obtained with both methods. Drainage is an important part of the operation with either potential or actual infection present.

CASE 3.—Mrs. A. B., a white American primipara, was admitted to the hospital on June 2, 1921. The patient had had four previous pregnancies, the first one being a forceps delivery, after eighteen hours in labor. No adequate information could be obtained as to the other three pregnancies. The patient on admission had a temperature of 99.4°, and pulse of 115. The head was the presenting part in an L.O.P. position. Two physicians had made prolonged efforts to deliver a persistent posterior occiput, before we first saw the patient. We decided to do a cesarean section with hysterectomy and drainage. As soon as the incision was made in the abdominal wall, the shoulder of the fetus was noticed through the uterine wall. This was the type that we have designated as the "balloon" type. The patient ran an elevation in temperature from 99.2° to 102.4° for twenty-three days following operation, after which the temperature remained normal until the patient was discharged on July 13, 1921, the forty-first day after admission.

CASE 4.—Mrs. C. L., a Polish primipara, aged twenty-four years, was admitted to the hospital in active labor on Sept. 28, 1921. She had been in labor for eighteen hours, and version and forceps delivery had been attempted before admission. The physical examination on admission revealed that the patient was in a state of shock with a temperature of 100.2°, a pulse of 144, and respirations of 36. The external genitalia were edematous and bruised. The cervix was found to be completely dilated, the breech presenting, and the membranes ruptured. There was a tight band encircling the presenting part which made it impossible to reach beyond it for a foot. The uterus was tightly molded about the fetus, and the lower uterine segment felt very thin, so that it was believed any manipulation might cause it to rupture. Under ether anesthesia, a cesarean section with hysterectomy and drainage was done, using three iodoform drains. The patient made an uneventful recovery, and was discharged on Nov. 2, 1921, the thirty-sixth day after admission.

CASE 5.—Mrs. A. R., a white American multipara, aged thirty, was admitted on Nov. 16, 1921. Her first pregnancy had resulted in a three months' abortion. The pains of her present pregnancy began on Nov. 11, 1921, and were slight and irregular for five days. An unsuccessful attempt was then made to deliver her with forceps whereupon she was sent to the hospital. On physical examination it was discovered that the patient had a justminor pelvis. She was extremely pale, her temperature was 98°, and her pulse 120. The head was high and free above the pelvic brim, and the fetus was dead. Vaginal examination revealed a fully dilated cervix; the contraction ring was about the neck of the fetus and a thin lower uterine segment. It was impossible for a hand to be passed into the uterus. An abdominal cesarean section with hysterectomy and drainage was done, three iodoform drains being used. The patient's convalescence was uneventful, and she was discharged in good condition on Dec. 17, 1921, this being the thirty-first day after admission to the hospital.

CASE 6.—Mrs. E. W., a white American multipara, aged twenty-seven, was admitted on July 8, 1929. Her first pregnancy, six years previously, had resulted in an instrumental delivery. This baby was living and well at the time of her present admission. The patient had had two operations during 1927, one an appendicectomy and right salpingo-oophorectomy, and the second a plastic repair. On admission she complained of slight pains and gave a history of slight bleeding early that day, headaches, and disturbances of vision. Her feet and legs were very edematous. The

following day, since no progress had been made, medical induction of labor was tried, but failed. Next, surgical induction of labor was attempted by the introduction of bougies, which were removed twenty-four hours after insertion. Although the cervix was dilated four fingerbreaths at this time, active labor pains had subsided. Early in the morning of July 11, the doctor in attendance attempted delivery by forceps, but this also was unsuccessful. Then, internal podalic version was tried. The head was displaced from its station, and one foot and one hand were brought down. At this point the uterus became very tetanic, and Bandl's contraction ring was quite visible through the abdominal wall. It became obvious that further manipulation would probably result in rupture of the uterus. At this time I was called into consultation and the question of craniotomy or cesarean section followed by hysterectomy was discussed. While fetal movements and heart sounds were absent, it was thought that the fetus might possibly be alive, and it was therefore decided to deliver by abdominal section. The findings before operation were: Marked ascent of Bandl's contraction ring, a foot down on one side of baby's head, a hand down on the other, one was unable to pass a hand into the uterine cavity, because of contraction of the lower uterine segment, all the parts seemed to be "frozen," and head was not engaged.

A supravaginal hysterectomy was performed, and a stillborn child was delivered. Drainage was established, and the patient reacted well following the operation. Except for a slight attack of bronchitis on the fifth and sixth days after operation, the patient made an uneventful recovery, and was discharged on Aug. 5, 1929, the twenty-fifth day postpartum.

#### CONCLUSIONS

Embryotomy is not without danger to the mother, especially in certain types of cases. These dangers are hemorrhage, shock, rupture of the uterus, and infection.

Therefore, in cases in which craniotomy is even more difficult and hazardous than usual, I feel that cesarean section with hysterectomy and drainage offers the safest and best means of delivery, and should be performed in preference to embryotomy.

The necessity for the performance of this operation is rare, as the indications for embryotomy are fortunately becoming fewer of late years. Improved obstetric teaching and supervision in medical schools and hospitals have resulted in more adequate prenatal care, and more intelligent and careful obstetric practice. However, no problem presents greater need for good and careful judgment in its management than a dystocia which has been badly handled before consultation.

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#### Convert, P.: Two Cases of Peritoneal Hemorrhage Resulting From Follicular Rupture, *Bull. de la Soc. d'obstet. et de Gynéc.* 25: 148, 1936.

The author reports two cases of extensive intraperitoneal hemorrhage following the rupture of an ovarian follicle. In both instances laparotomies were performed and the bleeding follicles sutured. In the discussion of this paper Cotte emphasized that in this type of case conservatism should be practiced. It is not necessary to remove the involved ovary, but only to suture the lacerated follicle. The second point brought out by Cotte is that as far as he knows there has never been a recurrence of this condition in any patient.

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## BRENNER TUMORS OF THE OVARY

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THIS report, based on four cases of Brenner tumors of the ovary, concerns itself with a histologic study and comments on the histogenesis. The importance of these tumors has not been stressed because of their rarity, benign character and lack of hormonal significance. Moreover, the tendency to confuse them with the folliculoid type of granulosa cell neoplasms, and their possible rôle in the etiology of pseudomucinous ovarian cysts warrant their further consideration.

The first clear picture of the histologic features of this neoplasm was presented by Orthman in 1899. It was not, however, until 1907, when Brenner described three cases under the designation of "oophoroma folliculare," that attention was directed toward the study of these tumors.

The Brenner tumors may vary in size from a minute nodule, 2 mm. in diameter, to a neoplasm as large as an adult's head. Though usually spherical or ovoid in shape they sometimes are irregularly nodular. The color is white or yellowish white, distinctly resembling a fibroma. Meyer differentiated a solid and a cystic type. The former is composed essentially of epithelial strands in a fibrous groundwork. Under magnification with the hand lens, small cavities may occasionally be discerned, varying from pinhead to cherry size, and containing an opaque, viscid, yellow brown fluid. The second and less frequent type consists of a solid Brenner tumor in the wall of a pseudomucinous or, rarely, serous cystoma.

Microscopically, the most characteristic feature is the epithelial strands which ramify in branching fashion through the connective tissue matrix. These are seen as round, oval, or longitudinal collections of an indifferent type of cell arranged in the form of pavementlike epithelium. The cells are rather large, irregular, polygonal or oval in shape with a distinct cell membrane. The cytoplasm stains faintly and appears finely granular. The nuclei are oval or slightly irregular, with distinct chromatin granules. When present, the cavitations within the epithelial nests may be only one to two cells in diameter or larger, single or multiple. The content of these cystic spaces appears often as a homogeneous, colloid material staining pink with eosin, and yellow with van Gieson. Spherical droplets of varying size and desquamated epithelium may be present. The layer of cells immediately surrounding the cavities is of particular interest. The more minute cavities may have no such differentiated layers. Some are lined by a single layer of flattened or cuboidal cells with an occasional thickening in which several layers are present. Others, however (Fig. 7), may be partially surrounded by cylindrical epithelium with basal nuclei, which shows abrupt transition into the typical indifferent type of epithelium. These cylindrical cells in many instances have been shown to take a mucicarmine stain, indicating their mucinous nature. The connective tissue between the epithelial strands is rather dense, moderately cellular and arranged in a haphazard, irregular, interlacing fashion. Areas of hyaline degeneration are usually present, and occasionally evidences of calcification are noted. The tumor as a whole is relatively avascular.

Clinically the Brenner tumors do not give rise to any symptoms or signs that are distinctive. We have been able to find 72 cases in the literature, to which 4 cases are now added. There have been two instances of bilateral ovarian involvement. Several cases have been described under other names, such as folliculoma, granulosa cell tumor, oophoroma, adenofibroma cysticum papillare ovarii, etc. An analysis of the age incidence reveals that they have been most commonly found after the menopause. Thus of the 72 cases in which the age was given, 76 per cent occurred after the fortieth year, and 60 per cent postmenopausal. The benign nature of these neoplasms is evidenced by the absence of invasive qualities, mitoses, metastases, or recurrences.

#### CASE REPORTS

In the four cases presented below only the pertinent clinical findings are given.

CASE 1.—A thirty-five-year-old woman was admitted to the Gynecological Service of Dr. R. T. Frank in January, 1932. She had been married for twenty years and had borne four children. The menstrual history was normal. She complained of intermittent right lower quadrant pain of several years' duration. The findings on examination suggested the presence of small uterine fibroids with diseased adnexa. A supravaginal hysterectomy and bilateral salpingo-oophorectomy were performed.

On gross examination of the removed organs, the uterus was found to be slightly larger than normal and contained several small fibromyomas with minute areas of adenomyosis. Both fallopian tubes were thickened and bound to the ovaries and uterus. The left ovary contained an orange-sized chocolate cyst. The right ovary was irregular in shape, covered by adhesions and showed the presence of several small follicular cysts. It measured 4 by 3 by 1.75 cm. On section, a well-defined, small, yellow white, solid nodule, measuring 7 by 5 by 4 mm. was noted within the parenchyma near the hilus of the ovary. No cavities were present, grossly.

Microscopically, the organs showed multiple fibromyomatous seedlings, adenomyosis uteri, bilateral chronic salpingitis, and endometriosis of the ovaries. The nodule within the right ovary proved to be a Brenner tumor (Fig. 1). The latter was of the solid type, with 4 to 5 microscopic cavitations within the epithelial islets. The connective tissue completely surrounded the epithelial structures, was moderately cellular, and was differentiated easily from the ovarian stroma. The strands were round, oval, or irregular in shape, of varying size, and were distributed sparsely throughout the fibrous matrix. About them the connective tissue appeared compressed and more conspicuous. In one area a crescent of hyalinized tissue could be seen. The epithelial cells were round to polygonal in shape, with lightly staining cytoplasm. The nuclei were fusiform or oval in contour, with fine chromatin particles and distinct nucleoli. Near the tumor, within the hilus of the ovary, remnants of the rete ovarii could be seen, in addition to an area of endometriosis.

CASE 2.—The patient was a sixty-year-old woman who was originally admitted to the Medical Service of Dr. B. S. Oppenheimer in July, 1935 for symptoms referable to bilateral renal calculi with hydronephrosis and pyelonephritis. She had been married for thirty-eight years, had had four children and was past her menopause. In an effort to combat a mounting azotemia, a nephrostomy was performed. A general infection with *B. pyocyaneus* supervened, and the patient died on the second postoperative day. At autopsy the pelvic organs presented multiple subserous, intramural, and submucous fibroids, a right multiloculated parovarian cyst and normal tubes and left ovary. The right ovary was approximately normal in size, measuring 3 by 2 by 0.5 cm. Its surface appeared corrugated. On section

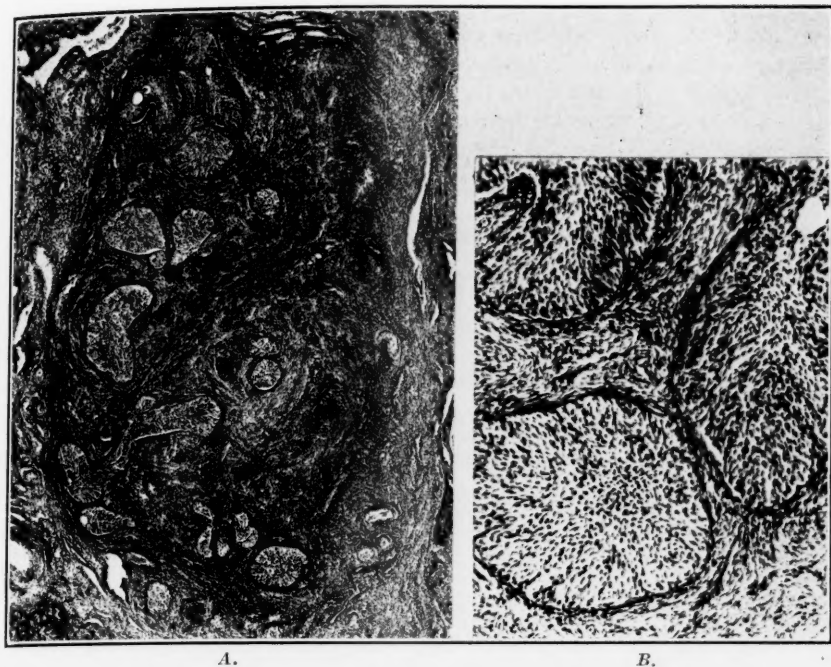


Fig. 1.—A, Case 1. Brenner tumor of the solid type. B, Higher magnification of A.

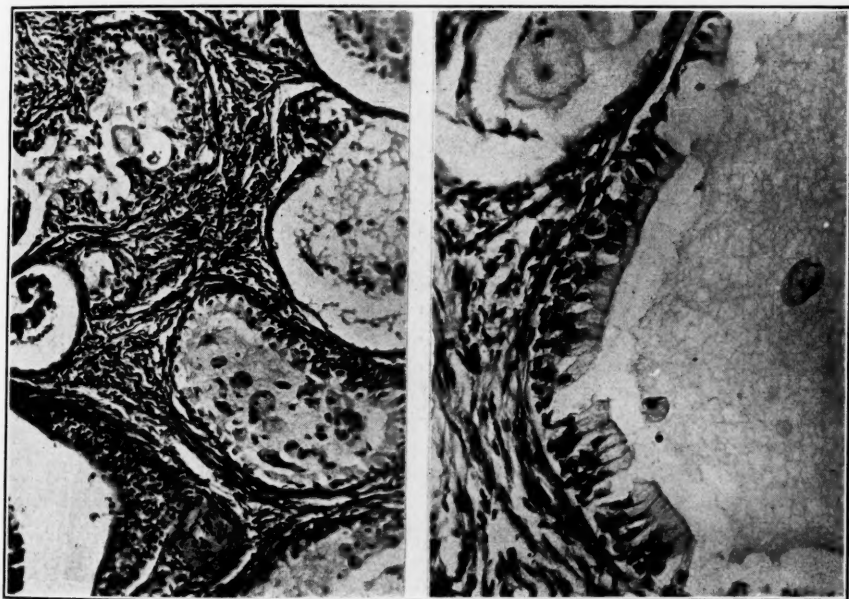


Fig. 2.

Fig. 3.

Fig. 2.—Case 2. Cavitations within the epithelial strands of a Brenner nodule. The lining consists of either a thickened layer of indifferent polygonal cells or flattened, cuboidal or cylindrical epithelium.

Fig. 3.—Case 2. High power of one of the cavities in Fig. 2, showing high cylindrical epithelium with basal nuclei. These cells and the cyst contents take a positive mucicarmine stain, indicating their mucinous nature.



several corpora albicantia were evident. Near the hilus, there was a small oval-shaped area which measured approximately 8 by 5 by 7 mm. Its outline was not sharply demarcated from the surrounding stroma, and its color only slightly more yellow white. It had a porous appearance, being studded by numerous small cystic areas varying from pinpoint to 1.0 mm. in diameter, which on section contained colloid material.

The ovarian nodule on microscopic examination was found to be a Brenner tumor. It differed from the others in that many vessels from the ovarian ligament were interspersed between the epithelial strands. The latter were numerous and for the most part cystic (Fig. 2). The contents of some of the larger cavitations included degenerating cells. A few of the cavities were lined only by indifferent cells. Others were partially or completely surrounded by a layer of cylindrical, cuboidal, or fusiform cells. In one of the more solid portions of epithelium, a radial arrangement of high cylindrical cells with basal nuclei could be seen about a central pinpoint space. With van Gieson and azocarmine stains, the condensation of fibrous tissue about the epithelial islets was especially evident. Examination with the mucicarmine stain brought out the mucinous nature of the columnar cells and the cyst contents (Fig. 3).

CASE 3.—A forty-five-year-old woman, gravida v, para iii, was admitted to the Gynecological Service of Dr. R. T. Frank in September, 1935. Her

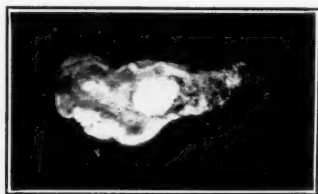


Fig. 4.—Case 3. Hemisected ovary. The well demarcated Brenner tumor is white in color and resembles a fibroma.

menstrual history was normal aside from a four-month period of amenorrhea, immediately preceding her admission. A diagnosis of large degenerating fibroids, gravidity, and syphilis was made, and a supravaginal hysterectomy and bilateral salpingo-oophorectomy were performed. Examination of the operative specimens confirmed the clinical diagnosis. A corpus luteum of pregnancy was found within the right ovary. The left ovary measured 4 by 2.5 by 1.25 cm. On section, between one pole and the hilus, a well demarcated, yellow white, oval-shaped nodule was found, which stood out in contrast to the grayish ovarian parenchyma about it (Fig. 4). It measured 7 by 5 by 9 mm. and appeared solid, but on serial section many minute, pinhead-sized cavities were revealed. Microscopically, the conspicuous feature of this Brenner tumor was the numerous cystic dilatations lined by flattened or cuboidal epithelium and containing pink staining, homogeneous substance. Within the narrow lamellae of connective tissue which separated these cavities, small epithelial foci were distributed (Fig. 6). One of the strands (Fig. 7) contained a cavity which was lined for the most part by large cylindrical cells with basal nuclei and sharp inner margins. At one point of its border, the cylindrical cells merged into the polygonal partially degenerated cells which made up the rest of the epithelial strand. The transition from undifferentiated cells into littoral, cylindrical epithelium seemed evident. The cysts which were so conspicuous in this case undoubtedly began as small cavitations and enlarged to finally compress the surrounding cells to a single layer of flat or cuboidal epithelium.

CASE 4.—This case was described in 1922 by Geist in a study of the histogenesis of ovarian tumors. It was classified at that time as a "tumor arising from persistent embryonal structures." The patient was a woman of fifty-two years who had complained of enlargement of the abdomen of several months' duration.



Fig. 5.—Case 3. Several of the cavitations have expanded at the expense of the epithelial structure in which they arise, leaving only a single layer of lining epithelium.

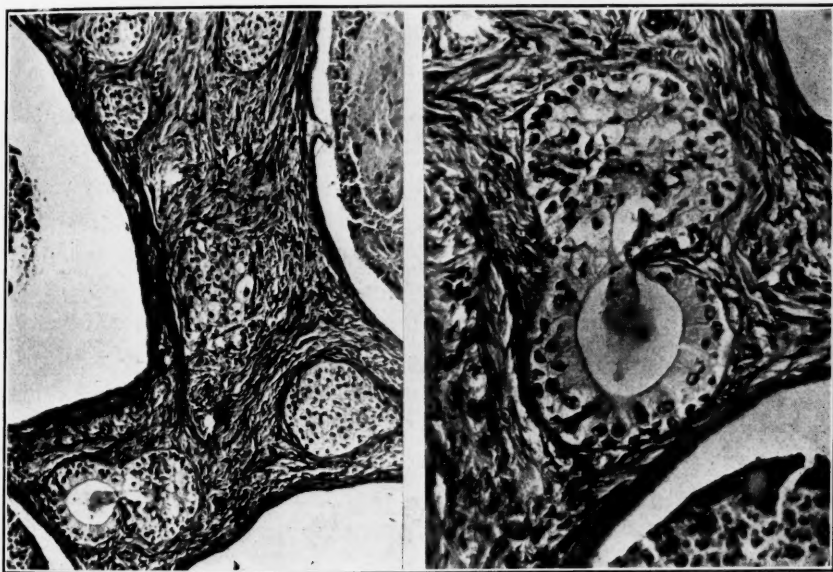


Fig. 6.

Fig. 7.

Fig. 6.—Case 3. Typical islets of pavement-like epithelial cells in a connective tissue matrix.

Fig. 7.—Case 3. Higher magnification of Fig. 6, showing the transition from indifferent to cylindrical cells.

She had never been pregnant and had not menstruated since her twenty-fifth year. Physical examination showed an abdominal mass extending to the umbilicus. A laparotomy was done and a large ovarian tumor was found. A complete hysterectomy was then performed. On gross examination it was seen that one ovary was

the site of a rather large solid tumor, apparently a cellular neoplasm, which histologically proved to be a typical adenocarcinoma. The other ovary was somewhat enlarged and contained a dense white area, 3 cm. in diameter, at one pole opposite the ovarian ligament. On reexamination this presented the typical features of a Brenner tumor. Attention was drawn at that time to the fact that in the larger cysts the lining epithelial elements were cuboidal, and in some instances approached very closely the high cylindrical cells with basal nuclei which line the loculi of pseudomucinous cysts of the ovary. It was suggested that the enlargement and coalescence of cysts within the epithelial strands, lined by a varying type of epithelium apparently transformed from the polygonal cells, could well give rise to the formation of the large pseudomucinous or serous cystomas of the ovary.

#### HISTOGENESIS

The occasional presence in the subserosa of the fallopian tube, mesosalpinx or ovarian ligament of isolated, epithelial foci resembling a single Brenner strand in all details has long been recognized. Though often found only on microscopic section, they may sometimes be grossly recognized on close scrutiny as minute 0.5 to 1.0 mm., white or yellowish, rather firm nodules or cysts directly beneath the serosa and movable with it. Histologically they consist of pavement-like or polygonal, closely packed cells with clear cytoplasm, deeply staining nuclei and distinct nucleoli. Finely fibrillated connective tissue surrounds them. Cystic degeneration may take place with the resultant formation of cavities, lined by either many-layered, flattened, cuboidal or cylindrical cells. The coagulated contents, often containing disintegrated cells, are analogous to those found in the cysts of Brenner tumors.

The theory that these structures are precursors of the Brenner tumor has been accepted by some authors. However, several objections have been raised: namely, the extremely rare finding of these cellular foci within the ovarian parenchyma of adults, and the failure of Brenner tumors to develop within the mesosalpinx or about the fallopian tube.

Recently Muller was able to correct the earlier impression concerning the rarity of the "paramalpighian nodules," as he terms them, within the adult ovary. In a series of 251 operative specimens, these lesions were found about the adnexa in 12 per cent of the cases. In 2.8 per cent they were discovered within the ovarian parenchyma, giving an incidence in the positive cases of 23.3 per cent for ovarian localization.

During the routine examination of an ovary removed at autopsy in the laboratories of the Mount Sinai Hospital in a sixty-three-year-old woman who died of general arteriosclerosis and cachexia, a structure was found within the cortex which consisted of a triangular area of indifferent cells adjacent to two small cysts lined by flattened or cuboidal epithelium. This on serial section proved to be a single focus. Reference to Fig. 9 illustrates the striking resemblance of its architecture to that of the tumor depicted in Fig. 5.

It is Meyer's belief that the coelomic epithelium with its unusual potentiality for abnormal differentiation gives rise in the course of embryonal development to small groups of cells within the ovarian cortex which have been termed Walthard cell nests. These indifferent cell complexes, sometimes accompanied by mucous epithelial cysts, were found by Walthard in the ovaries of the newborn and young children. The same designation has been applied to the epithelial formations beneath the serosa of the tubes and mesosalpinx. Depending upon a stimulus which is as yet unknown (hormonal and nutritional influences have been suggested), these special cell foci within the ovary may develop in several directions. If they retain their indifferent character, they may give rise to solid Brenner tumors. If the differentiation tends more in the direction of cyst formation the latter may predominate. Meyer contends that the Brenner tumor belongs genetically in the



Fig. 8.

Fig. 9.

Fig. 8.—Paramalpighian nodule occasionally found beneath the serosa of the fallopian tube, mesosalpinx or ovarian ligament. Its similarity to the epithelial strands of the Brenner tumor is evident.

Fig. 9.—A single epithelial focus with adjacent cystic dilatations found in the ovarian cortex of an adult.

series including the majority of serous cystomas, papillary cystadenomas with partial fibrosis, the adenofibromas and mixed seromucinous tumors.

Plaut holds that it is more probable that epithelial proliferation and transformation of the peritoneal lining may result in the formation of these cell nests.

Muller believes that the paramalpighian nodules of the ovary are derived from the original proliferations of the surface epithelium covering the asexual germinal gland in the early embryonal stage. Some of the indifferent cells directly beneath the surface remain dormant until under adequate stimulation they show their potentiality for bud formation. He explains the occurrence of identical cellular structures outside the ovary as follows: "The surface epithelium of the ovary and the peritoneal covering of the mesosalpinx and tube are derived from the coelomic epithelium in a single region, the 'germinal zone.' The tendency toward proliferation is not sharply limited to the coelomic epithelium covering the germinal gland

but also extends to the mesothelium immediately about it. When the latter is forced back a little later by the early tubal outline to form its peritoneal surface, it carries with it several mesothelial cells in the mesenchyme beneath it, which may under stimulation give rise to epithelial structures.''

The failure of Brenner tumors to develop within the tube or mesosalpinx cannot be adequately explained at this time. One can only speculate concerning the variations in circulation and nutrition, the question of hormonal influence, and the definitely greater propensity on the part of the ovary for tumor formation.

The histogenetic relationship of the Brenner epithelial structures to the development of pseudomucinous ovarian cysts has been mentioned. A review of the various transition stages starting with the solid strands of indifferent epithelial cells, followed by the development of cavities without a distinct lining layer of cells, and ultimately by the formation of cysts, partially surrounded by cylindrical cells having a typical pseudomucinous appearance and taking a mucicarmine stain, makes this possibility seem more likely. The final link in the chain is the large pseudomucinous cystoma with a small Brenner tumor in its wall. It is also possible that pseudomucinous cysts may develop directly from the precursors of the Brenner tumor. It is not improbable, moreover, that if all large pseudomucinous cystomas were carefully examined, small Brenner nodules might be found in their walls in a higher percentage of cases than has hitherto been reported. The frequent coincidental occurrence, however, of pseudomucinous cysts and dermoids, and the presence of small mucous cysts beneath the surface epithelium of the ovary, suggest additional etiologic possibilities.

#### SUMMARY

The pathologic and clinical features of Brenner tumors are described. Four cases are reported to illustrate microscopic variations. Attention is drawn to the occasional tendency to confuse this neoplasm with the folliculoma or granulosa cell tumor. The histology strongly suggests an etiologic relationship between these tumors or their precursors and pseudomucinous ovarian cysts. Careful examination of all ovarian cystomas may reveal a more frequent occurrence of Brenner nodules within their walls. The histogenesis of the Brenner tumors may on comparative histologic considerations be traced back, first, to a single epithelial focus of similar structure, termed the paramalpighian nodule or Walthard cell nest, and from there to the coelomic epithelium of the developing embryo.

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## BENIGN AND MALIGNANT POLYPS OF THE CERVIX UTERI\*

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CERVICAL polyps occur most frequently after the menopause, although they may appear earlier in life. The incidence of primary carcinoma of a cervical polyp is very rare judging from the literature. Among thirty-two cases seen at the Cook County Hospital Tumor Clinic, one primary carcinoma was seen. As the clinical signs do not aid in the diagnosis, microscopic examination becomes imperative.

The complete histories of the cases of mucous polyps of the cervix from the Cook County Hospital Tumor Clinic have been studied. This covers the period from January, 1932, through December, 1935. There were 2,048 gynecologic cases admitted to the clinic, of which 32 were mucous polyps of the cervix. These cases were carefully analyzed as to age incidence, parity, symptomatology, association with other lesions, microscopic diagnosis, and treatment.

COOK COUNTY HOSPITAL TUMOR CLINIC			SCHROEDER	
AGE INCIDENCE	NO.	%	NO.	%
Under 20 years	0	0.0	1	1.4
20-30 years	1	3.1	2	2.9
30-40 years	7	21.8	14	30.0
40-50 years	12	37.5	32	45.7
50-60 years	6	18.7	18	25.7
60-70 years	5	15.6	2	2.8
70-80 years	1	3.1	1	1.4
Total cases	32		70	

### SUMMARY

The greatest number of patients were between the ages of forty and fifty years. Eight patients or 25 per cent were under forty years of age. Twelve or 37.5 per cent were over fifty years of age.

\*Read at a meeting of the Chicago Gynecological Society, February 21, 1936.

The symptoms were leucorrhea, menorrhagia, and metrorrhagia. Fifteen or 46.8 per cent had leucorrhea, 3 or 9.3 per cent had menorrhagia, and 22 or 68.7 per cent had metrorrhagia. One patient did not have any symptoms.

The associated pathology in this group was cervicitis, prolapse, fibroids, retroversion, and cystocele. Twenty or 62.5 per cent had cervicitis, 3 or 9.3 per cent had

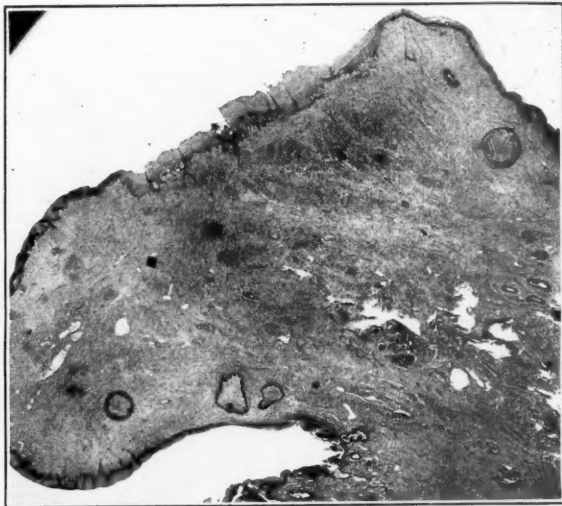


Fig. 1.—H. & E.  $\times 8$ . Photomicrograph of polyp arising from lower lip (portio vaginalis) of cervix uteri. The stroma is mostly fibrous and contains about six glands, four of which have undergone cystic dilatation. The polyp is covered with stratified squamous epithelium; in places there is some thickening. The base is very broad;  $12 \times 10$  mm.

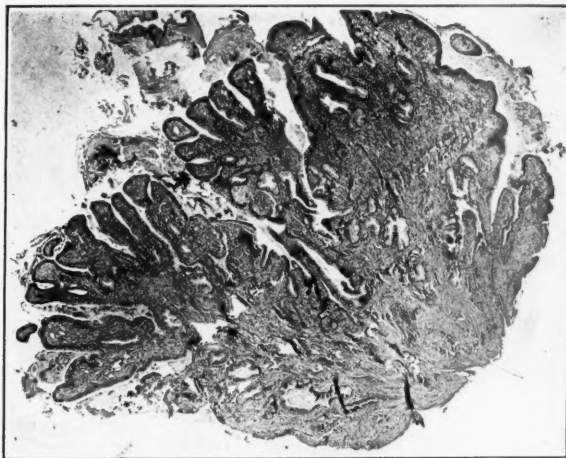


Fig. 2.—Case 10. H. & E.  $\times 31$ . Photomicrograph of benign mucous polyp of cervix uteri, composed of numerous racemose glands, lined with tall columnar mucous secreting epithelium. The stroma is fibrous. The external surface is lined with tall columnar epithelium.

an associated prolapse, 2 or 6.2 per cent had a retroverted uterus, 1 or 3.1 per cent had fibroids of the uterus, and 1 or 3.1 per cent had a cystocele. There was 1 case each of pregnancy, diabetes, syphilis, and an enlarged cystic ovary. Six patients had no associated pathology.

Of the 32 cervical polyps, 31 were definitely benign and 1 was reported as anaplastic epidermoid carcinoma. The following is the case report on Patient 14, with an anaplastic epidermoid carcinoma of a cervical polyp:

Married, white woman, aged fifty years, entered the Clinic on July 21, 1934. She was a multipara (para ii) and had had a normal menopause five years previously. The present complaint was vaginal bleeding intermittently for the last three years. In her history she states she was given local treatments about one year ago for an eroded cervix. This helped to decrease the bleeding for about eight months, but for the last four months bleeding had increased again. Vaginal examination showed a small cervix with cervicitis and a small polyp about 1½ cm. in diameter attached to the posterior lip of the cervix by a short pedicle. The polyp and pedicle felt quite firm and bled readily when manipulated. The corpus and



Fig. 3.



Fig. 4.

Fig. 3.—Case 23. H. & E. Stain  $\times 210$ . Photomicrograph showing racemose cervical glands of a cervical polyp exhibiting moderate metaplasia. Note conversion from tall columnar epithelium to flat squamous epithelium and some atypical overgrowth with partial filling of the gland lumen.

Fig. 4.—Case 31. H. & E.  $\times 75$ . Photomicrograph of mucous cervical polyp exhibiting extreme degrees of metaplasia. Notice dilated mucous glands in the left and lower portions of picture. The centrally placed glands show a transition from tall mucous-secreting columnar epithelium to a flat squamous type with benign neoplasia. Some lumina are quite filled. The basement membranes are intact. There is moderate periacinar round cell infiltration, and vascular dilatation and edema of the stroma.

adnexa were negative. The polyp, including the pedicle, was removed with a Jackson square jaw biting punch forceps. The microscopic examination of a section through practically an entire cross-section of the polyp showed on one side a columnar cell covering and on the top and the opposite side stratified squamous epithelium. The uppermost area with stratified epithelium, showed marked irregularity with anaplastic proliferation, a breaking through the basement membrane and a heavy infiltration of the stroma by rapidly advancing anaplastic epidermoid malignant cells. The greater part of the right half of the section was invaded by solid malignant cell masses which invaded almost to the base of the pedicle at

the bottom. Higher magnification revealed all the typical characteristics of malignancy, including loss of polarity, hyperchromatism, mitoses, and variation in size and shape of nuclei and cells. Round cell infiltration was present in the stroma surrounding the cell masses. These masses encroached upon the racemose glands lined by the tall columnar mucous secreting epithelium. The treatment included the insertion



Fig. 5.—Case 14. Photomicrograph of the cervical polyp arising from the portio vaginalis exhibiting an anaplastic epidermoid carcinoma to the right half and at the base. H. & E. Stain  $\times 36.5$ .



Fig. 6.—Case 14. Photomicrograph of square area outlined in Fig. 4 ( $\times 190$ ). Note anaplasia, and mitoses, hyperchromatism and giant malignant cells.

of 1,700 mg. element hr. of radium filtered with 2 mm. of brass into the cervical canal in three divided doses at weekly intervals, total dosage 5,100 mg. element hr. radium. At the present time there is no evidence of recurrence (seventeen months later).

## COMMENT

This case is a primary carcinoma confined within a mucous polyp of the portio vaginalis. It was covered with typical squamous epithelium over the greater part of the surface. The cancer cells could be seen invading the pedicle of the polyp also.

Mucous polyps of the cervix including the pedicle should be removed and subjected to microscopic examination because of the possibility of malignant degeneration. In benign cervical polyps, removal was followed by cauterization of the cervix with the electric cautery, to prevent recurrence and to clear up the associated cervicitis. The patient should be told to watch for bleeding and vaginal discharge and to return at stated intervals for observation and follow-up. Polyps may recur or arise in other places. If the polyp is found to be a cancer, then irradiation or radical panhysterectomy is indicated.

In the cases studied, the polyps were removed and the cervix cauterized in 24 cases or 75 per cent. Vaginal hysterectomy was done in 3 cases or 9.3 per cent because of the associated prolapse of the uterus. Radium was used in five cases or 15.6 per cent.

4554 BROADWAY

## DISCUSSION

DR. HENRY SCHMITZ.—Polyps may assume peculiar cell formations. It may be impossible to determine the primary origin of the cells or to render a definite diagnosis, especially with regard to malignancy. The term "metaplasia" is often applied to the reparation processes in inflamed polyps and cervixes. The use of the term metaplasia is confusing and it should be clear that the process of repair is not metaplasia.

The differential diagnosis between inflammatory hyperplasia and malignant hyperplasia should not offer any difficulty. In inflammatory hyperplasia we have a diffuse process involving a whole organ or tissue, and the cells are mature or true to type. On the other hand, in malignant hyperplasia we have a circumscribed process from an isolated group of cells, atypia of cells, and there is always penetration of the basement membrane. Long-continued irritation from various causes may terminate in inflammatory hyperplasia in the polypus and the cells may finally become atypical. We are dealing then with a transitional stage between inflammatory and malignant hyperplasia, often called precancerous. It may not be true that all precancerous stages pass on into true carcinoma, but clinical experience shows that true carcinoma follows as a rule.

DR. CHARLES E. GALLOWAY.—This subject brings up the question of early diagnosis of malignancy, especially of the cervix. We know how to diagnose a carcinoma that is as big as a pea, but the question comes up, is that of an early carcinoma. We should all try to use the microscope because in the near future early malignancy may be diagnosed by this means almost entirely. Our technicians should make better sections and tissue preparations, especially in the operating room. Tissues must be fixed properly and sectioned properly because it is under high power that the diagnosis of early carcinoma is going to be made.

Another aspect of which we know little is the time element in cases of malignancy, especially of the cervix. There is some evidence to show that tissue can resemble carcinoma and lie dormant for a period of years and still not affect the individual.



## INDICATIONS FOR CONTRACEPTION FROM THE POINT OF VIEW OF THE OBSTETRICIAN AND GYNECOLOGIST\*

THADDEUS L. MONTGOMERY, M.D., PHILADELPHIA, PA.

THE path of the pioneer in obstetric practice has not always been smooth. Apropos of this observation, the late Barton Cooke Hirst remarked, "We need but recall the fate of Dr. Werth of Hamburg who in 1522 put on the dress of a woman to attend and study a case of labor, and who was burned alive for his pains; or that of Dr. Willoughby, one hundred years later, who assisted his daughter, a midwife, in a difficult labor, and was obliged to crawl into the darkened room on hands and knees."

From such statements of medical history it appears that the attempt of the curious to learn more of the secrets of maternity is not always smiled upon, nor the application of medical science to midwifery openly welcomed. Our rugged forebears are perhaps to be thanked not only for their scientific contributions but also for the fact that we are alive, and today do not conduct labor beneath a sheet, or with darkened glasses.

It is unnecessary to turn back four hundred years to note improvement in attitude of medical profession and laity toward the solution of unsettled problems. Within the memory of this author, physicians of presumably scientific inclination, gathered together to exchange views upon subjects professional, have given vent to such violence of argument that the meetings ended in the unlimbering of animosities and exchange of epithets.

The Obstetrical Society of Philadelphia, and intellectual progress in general, are to be commended that upon this second day of January, 1936, our members can meet together and discuss in quiet and unimpassioned fashion a controversial topic.

That contraception is a controversial subject of the day few will deny, for the contention between opponents and proponents wages hotly. I must confess that I am so impressed with arguments in support and points in antagonism, and so influenced by personal observation of various types of patient, that my own views on the subject are singularly unsettled. I can do little more than present to you the difficulties of decision which arise in daily practice. To this end I shall cleave to

\*Read as a part of a symposium, before the Obstetrical Society of Philadelphia, January 2, 1936.

that phase of the subject which has been assigned and avoid becoming involved in the social and economic problems which are so closely related.

Two points are to be clarified before proceeding further. First, contrary to the impression which may be given by the wording of this program, the author in no way undertakes to represent in his beliefs the general opinion of the medical profession. To presume to do so would be an unwarranted assumption of authority and a failure to recognize the wide differences of opinion which exist among obstetricians and gynecologists. Second, the opinions expressed here do not represent the attitude of any department or hospital with which he is associated. The views are his own.

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It is generally conceded that in the presence of tuberculosis, heart disease, chronic nephritis, previous cesarean section, and certain other subacute and chronic ailments, the occurrence of pregnancy is additional menace to the patient's health, and that some method of avoiding or limiting offspring is desirable. However, the experienced obstetrician recognizes that the universal application of such policy is a mistake, and that the establishment of rigid rules of conduct even in these more frank medical indications is impossible.

He has seen too many instances in which an arrested pulmonary infection has, under careful supervision, withstood the test of pregnancy and the puerperium, has noted many a defective heart which has tolerated several pregnancies and carried its owner to an advanced age. Even in the presence of elevated blood pressure and apparent renal impairment, he has noted patients who enjoyed a high state of health during pregnancy and were left with no added renal damage.

On the basis of these observations, the obstetrician puts aside generalities, views each of his patients as an individual problem, and has small countenance for the policy of applying contraceptive measures merely upon the name of chronic disease.

On the other hand, if he follows this method of study to its complete application, that same obstetrician will meet with other women, a survey of whose disabilities will convince him that the occurrence, the continuation, or the repetition of pregnancy is a menace to health and life. Under such circumstances it is his place to consider carefully the duty to his patient.

It is in this group of clearly defined medical indication that the arguments for contraception make their strongest appeal. What seems more in keeping with the spirit of modern medicine than to prevent or circumnavigate ill health and death? Such an argument would be unanswerable—if the present methods of contraception were uniformly successful. In those very cases where avoidance of pregnancy is most to be desired, the methods frequently fail. Perhaps the failures

which we encounter in obstetrics give us a false impression of their frequency. Perhaps those failures are the effect of human frailty and are not to be attributed to faults in the method itself. Nevertheless, I am convinced by conversation with patients and physicians that many of the present methods of contraceptive technic are esthetically distasteful, and therefore not long continued with, and that, for the lower classes at least, they are practically impossible. The net result is that contraception proves an uncertain deterrent in the most urgent of indications.

In common with a considerable body of obstetricians, I believe that where permanent avoidance of pregnancy is necessary for medical reasons, the carefully controlled operation of abdominal hysterotomy and sterilization, performed during pregnancy or at term, as the conditions may direct, is the procedure of choice. Where only temporary avoidance of pregnancy is needed, the practice of contraception has a place, and under these circumstances should become more and more useful as the methods improve in effectiveness and ease of application.

At the present time there is a growing demand to extend the field of contraceptive practice, a demand which is growing among women themselves; and not only among those who have had repeated pregnancies, but women who work and wish to avoid childbirth temporarily or permanently, young married women who desire, for economic or other reasons, to avoid childbearing during the first year or two of marital life, women who wish to fully regain health before undertaking further pregnancy, and others who wish to space their pregnancies according to a preconceived plan. All such requests reduced to their final analysis are an expression of woman-kind's desire to exercise control of her environment, to regulate a function which in the past has regulated her, to eliminate the feared and the haphazard, and substitute the welcome and the planned.

Whether such ideas are practical, scientifically founded, spiritually correct, economically sound, and socially to be sustained seems to play little part in the ever growing demand for contraceptive knowledge.

What obstetrician is not each day implored by his puerperal patients to prescribe some dependable method of avoiding pregnancy until the patient "is on her feet again," "has replenished her financial stores," or "has time to enjoy her family." He is indeed a cold individual who has no sympathy for the viewpoint of such patients, particularly those who have been under his care for many months, and who now turn to him as their confidant, advisor in health, and truest friend.

Nonmedical as many of these situations appear, the law makes little attempt to interfere with this personal relationship of patient and physician, at least in private practice, and the doctor is left to follow the dictates of his own conscience in prescribing, or withholding. Before long and before he realizes it, he is soon thrust into the position

of arbiter of childbirth, saying to this woman, thou shalt have none, to that, thou shalt have one, and to another, thou shalt have many.

I am highly of the opinion that the medical profession was never intended to assume this responsibility nor that any individual physician desires to bear it. However, since there is no other individual or board which can assume this task, and inasmuch as there appears little possibility in our present disordered existence of one being agreed upon, the physician will continue to be thrust in this unique position, to be ridiculed by some and praised by others for doing that which his conscience dictates.

It is not my place in this dissertation to go into the question of contraception as an economic panacea, or as a method of curbing the reproduction of undesirables. Already I have extended the consideration of indications far beyond the field which is acceptable to many of you. Suffice to say that sociologists and anthropologists are becoming alarmed, and not without reason, over the drifts of population growth and the failure of the more intellectual classes to reproduce themselves. These same authorities condemn the practice of contraception as an instrument of still further class imbalance, finding the method unsuccessful where most needed and too successful where least indicated.

The implications of these findings, while not of direct bearing upon the science of medicine, are of interest and importance to any group of scientific men. This subject is too large to enter upon at this time, but there is one observation that I wish to leave with you. The people of the United States are not easily brought under prohibitions, as witness our recent experience with the liquor traffic; they, like all people however, are susceptible to suggestion. Instead of expending our energies upon the legal restriction of contraceptive practices, would it not be more effective, and is the time not ripe for a carefully laid campaign of propaganda setting forth the permanent joys of motherhood, the lasting pleasures of family life and of children, designed to encourage further reproduction by creating greater deductions in income tax and by making grants to worthy families? *Many would be led who cannot be driven.*

If there are any conclusions to be reached from this rambling discourse, they may be set down as follows:

1. The present technic of contraception is an unesthetic, unreliable method of avoiding pregnancy. Its successful practice should be limited to temporary ailments.
2. Under indications of a serious and permanent nature, such procedures as hysterotomy and sterilization are more dependable and are to be preferred.
3. A demand for the extension of contraceptive practices is growing among the female population and breaking all bonds of church and state.

4. There is a disposition at present to leave this problem, in the case of the individual patient, in the hands of the obstetrician, placing him in a unique and difficult position.

5. Certain socially minded and economically concerned groups propose contraception as a panacea for the problem of the poor. This proposal calls for critical inspection on the part of scientific men, and the physician should take appropriate interest in the correct solution.

6. Too much is expected of the practice of contraception as an instrument of racial betterment. Properly conducted propaganda designed to elevate the position of motherhood and extol the pleasures of family life will do more to increase reproduction in the upper classes.

1930 CHESTNUT STREET.

### NOTES ON THE USE OF THE RECENTLY INTRODUCED ERGOT ALKALOIDS IN THE PUERPERIUM

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THIS report adds an additional 218 cases in which ergotamine tartrate was administered in the puerperium, bringing the total to 618 so treated, and 116 who were given "ergoklonin," a liquid preparation of ergot claimed to contain the ergostetrine of Thompson. Ergostetrine, the active principle of "ergoklonin," is apparently identical with the ergometrine of Dudley and Moir. Although 33 other parturients were given ergotrate (the ergotocin of Kharasch, Legault, Davis and Adair), the number so treated is too small from which to draw any definite conclusions.

Ergotocin is marketed in tablet form, each tablet containing 1/320 gr. of the alkaloid. The dose employed in our series was 1/640 gr., repeated four times daily, for three successive days. Unfortunately, ergotocin is not stable in solution, so that its use as a puerperal prophylactic, other than the immediate control of bleeding, is precluded. It does seem reasonable to say, that when ergotocin can be had in stable solution or in smaller tablets, we may have a satisfactory puerperal, prophylactic agent.

The use of the various ergot alkaloids here described is primarily to obtain tonic contraction of the uterus, the early emptying of the uterine canal, the inhibition of the propagation of saprophytes, and the control of puerperal morbidity rather than to control postpartal hemorrhage. It is not the speed of action nor the intensity that is desired, although these are commendable attributes, but the persistence and tonicity produced and maintained. This is why the individual dose used has always been less than the one customarily prescribed.

#### ERGOTAMINE TARTRATE

As heretofore, 1 c.c. of ergotamine tartrate was administered, hypodermically, immediately after the expulsion of the placenta, and thereafter, 6 minims every four hours for 5 doses daily on the ensuing three days, orally. Among the 218 so treated, there were 95 primiparous and 123 multiparous women, including three sets of twins. 190 were in the occipitoanterior and 17 in the occipitoposterior position. There were 9 breech, 1 transverse, 1 brow, and in 3 the position was undetermined. Six infants were delivered with low forceps and 5 with midforceps. There were



one version and extraction, one breech extraction, and one bag induction. The placenta was removed manually twice. The operative incidence rose to 8.5 per cent. Approximately 29 per cent of the babies weighed between 3600 and 5400 gm.

*Involution.*—Again in this series as in the larger group, the uniformly small size of the uterus was quite apparent. The average height on first day was 12.62 cm., the extremes were 6 and 17 cm. Thereafter involution progressed steadily. On the tenth day the average height of the fundus of the uterus was a little over 1.8 cm. (Fig. 1).

*Lochia.*—In no case was the lochia noted as being profuse in amount, while in 3 it was absent. In 147 or 67 per cent it was moderate in quantity while in 30

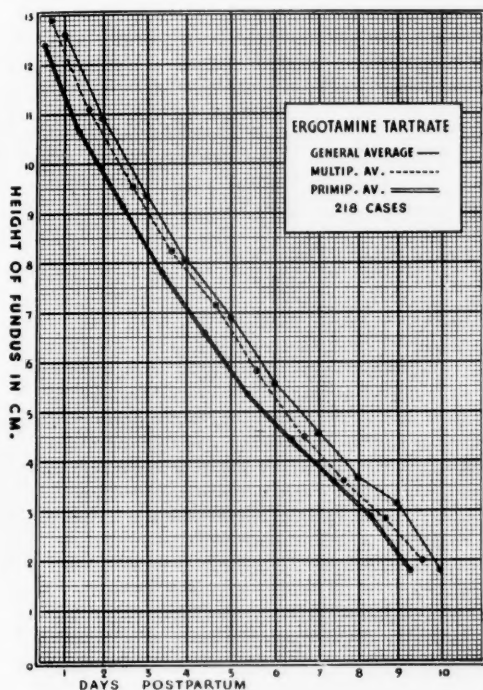


Fig. 1.

per cent it was scant. The character of the lochia followed a similar parallel. In 61 or 28 per cent it was noted as rubra. In 129 or 59 per cent it was serous, while in 26 or 12 per cent it was colorless.

In 6 cases or 2.7 per cent the lochia was foul. It is not unreasonable to suppose that the fertile soil so necessary for the development of the saprophyte is reduced to an absolute minimum. A 28 per cent lochia rubra, likewise, shows a fair control of the bleeding elements.

*Temperature.*—With involution progressing satisfactorily, and an absence of saprophytic invasion, it should follow, barring any nonobstetric infection, that few, if any parturients should have any fever. We have again elected to use the same three standards as heretofore, the American, British, and DeLee's. Our uncorrected morbidity rose slightly, but the operative incidence had also risen. Among the 10 febrile patients, there were one with bilateral hydronephrosis and hydroureters, one with acute cystitis, two with acute mastitis, three with sapremia, and three with acute endometritis, one of whom had an infected, episiotomy wound.

If we subtract the first four cases, the corrected morbidity is 2.75 per cent.

## ERGOKLONIN

For some reason, we have not had the success with ergoklonin that we had hoped. One hundred and sixteen parturients were given this alkaloid. They received two drachms immediately upon the delivery of the placenta and one-half drachm four times daily, on the succeeding three days.

There were 118 babies born, including two sets of twins: 104 were in occipito-anterior position; 6, occipitoposterior; 5, breech; and in 3, the position was undetermined.

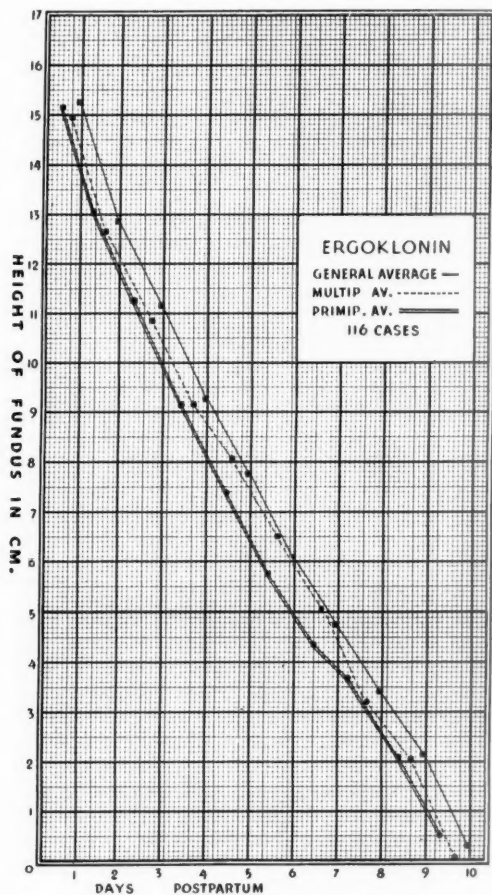


Fig. 2.

The operative incidence was 8.6 per cent, 6 were delivered with low forceps, one midforceps, one axis traction, and one had a bag induction.

Over 29 per cent of the babies weighed more than 3600 gm. (Table I).

*Involution.*—Involution proceeded quite satisfactorily. By the tenth day the fundus of the uterus was just palpable behind the symphysis pubis (Fig. 2). The greatest comparative discrepancy was in the first few days of the puerperium. The average involution for the first day was 2.5 cm. The ergoklonin must be credited with this marked contractile power, inasmuch as neither in the ergotamine tartrate group nor in the few cases receiving ergotrate did there appear so marked a first-day involution.

TABLE I. BIRTH WEIGHT

WEIGHT IN GM.	ERGOTAMINE TARTRATE PER CENT	ERGOKLONIN PER CENT
Under 2,250	1.6	5.3
2,250-3,600	69.13	65.48
3,600-4,050	19.42	22.12
4,050-4,500	8.57	7.08
4,500-5,400	1.00	

TABLE II. MORBIDITY IN 218 CASES

AMERICAN STANDARD*		BRITISH MED. ASSOCIATION ADDITIONAL		DE LEE STANDARD				TOTAL	
				FIRST DAY ONLY ADDITIONAL		ONE DAY OTHER THAN FIRST ADDITIONAL			
NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
10	4.5	3	1.83	10	4.5	29	13.3	52	24.1

\*Corrected morbidity according to American standard was 2.75 per cent.

However, a new factor made its appearance. Over 65 per cent of these women had pain, varying in intensity from mild to severe, and limited to the duration of the administration of ergoklonin. All this would seem to imply that the dose, one-half drachm, four times daily, was too large. Further evidence of perhaps a too tonically contracted uterus appeared in the lochia.

*Lochia.*—At the time of discharge from the hospital, the lochia was moderate in 87 or 75 per cent, scant in 16.5 per cent and absent in 7 per cent. It was colorless in 5.8 per cent, serous in 58.5 per cent and red in 26.5 per cent. That a too forceful contraction was being obtained was apparent by the unusual number of foul lochia discharges, 26 or 22.4 per cent. Within a short while after the cessation of the administration of this alkaloid the foul lochias cleared.

*Temperature.*—Among the 12 febrile patients, there was one with pyelitis, one with an ischio-rectal abscess, one had had a postpartum hemorrhage, one with an infected episiotomy wound, six with sapremia, and two with acute endometritis. This is an uncorrected morbidity of over 10 per cent. If the first two are eliminated the morbidity is still high, 8.5 per cent. It is noteworthy that the sapremias make up 60 per cent of the morbidity.

TABLE III. ERGOKLONIN MORBIDITY

AMERICAN STANDARD*		B. M. A. STANDARD ADDITIONAL		DE LEE STANDARD				TOTAL	
				FIRST DAY ONLY ADDITIONAL		ONE DAY OTHER THAN FIRST ADDITIONAL			
NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT	NO.	PER CENT
12	10.34	4	3.44	5	4.31	19	16.4	40	34.49

\*Corrected morbidity according to the American standard was 8.5%.

To those of us who watched these patients from day to day, it was apparent that the too tonic action of this oxytocic accounted for the large number of sapremic temperatures. It does appear, however, that in smaller amounts in like or at greater intervals far better results may be obtained.

## DISCUSSION

The administration of ergotamine tartrate in over 200 patients in the current series fully substantiates our previous findings.<sup>1</sup> That the morbidity rose only 0.5 per cent, despite a doubled operative incidence, from 4.25 per cent to 8.5 per cent, lends strong support to the feeling that a suitable oxytocic should be used in the lying-in period. The absence of pain and foul lochia in these patients bespeaks the absence of undue tonic contractions of the uterus.

Regrettably, the results with ergoklonin were not as satisfactory. Although the involution of the uterus was all that could be desired, too many had two annoying symptoms, pain and foul lochia.

Our experience with ergotrate (ergotocin) is quite meager, being limited to a few more than 30 patients. These showed an equally rapid involution, a larger percentage of scanty lochial discharge, 26 out of 33, and only one had a foul lochia.

Dr. DeLee<sup>2</sup> in a personal communication, writes, "Many years ago, over forty, my preceptor used to give ergot regularly, after every delivery. However, with the improvement of our methods of asepsis, we found it was not necessary and gave it up.

"Latterly, with the increase of the dangers of infection incident to childbirth in general hospitals, where the maternity wards are not as well isolated as they might be, perhaps we ought to resume this ancient practice."

With the essence of this I wholeheartedly agree. However, we cannot fail to note that our morbidity rose only one-half of 1 per cent, while the operative incidence increased 100 per cent.

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- (1) *DerBrucke, M. G.*: J. A. M. A. 105: 867, 1935. (2) *DeLee, J. B.*: Personal Communication, Nov. 27, 1935.

901 WASHINGTON AVENUE.

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**Lyon, D. M.**: Mandelic Acid in the Treatment of Urinary Infections, Brit. M. J. 2: 1096, 1935.

The ketogenic diet treatment of urinary infections introduced by Clark and Helmholtz has proved efficacious. Its bacteriostatic power is convincing, but a practical difficulty arises in carrying it out. It entails rigid skilled dietetic supervision, is nauseating and expensive. It owes its bacteriostatic power to the presence of  $\beta$ -hydroxybutyric acid in the urine of patients under a ketogenic diet treatment. No effect is produced on urinary infection by the oral administration of this acid, since it becomes completely oxidized before reaching the urine.

Attempts have been made to find a nontoxic acid which would exert a similar bacteriostatic effect but which would not be oxidized when given orally and which would be excreted unchanged in the urine. Rosenheim claims mandelic acid fulfills these requirements. He administered 12 gm. daily in divided doses. The urine is rendered strongly acid by ammonium chloride gr. 10  $\times$  6. It forms an effective substitute for the ketogenic diet treatment.

The author reports 16 cases in 13 of which the treatment was successful in sterilizing the urine fairly rapidly. The series comprised male and female patients having diverse organisms and chronic infections of the urinary tract. This treatment is contraindicated in patients showing renal impairment due to the deleterious effects of acids on the kidney function in such individuals. In all other cases of severe chronic urinary infections it is a simple and practical therapeutic advance.

F. L. ADAIR AND S. A. PEARL.

## PREMATURE SEPARATION OF THE PLACENTA

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**A**CCIDENTAL uterine hemorrhage of Rigby,<sup>1</sup> or ablatio placentae of Holmes,<sup>2</sup> or abruptio placentae of DeLee<sup>3</sup> is defined in the standard textbooks of obstetrics<sup>4-9</sup> as uterine hemorrhage from a premature separation of a normally implanted placenta. The case reported and other experiences of the author have suggested that this condition should be defined as uterine hemorrhage from a premature separation of the placenta, irrespective of its attachment to either the upper or the lower uterine segment. On the basis of the underlying pathologic and the physiologic changes, I suggest a clinical classification of the contractive and the retractive types.

### CASE REPORT

Mrs. J. B., aged twenty-six years, colored, gravida x, and para vii. The family and personal history were of no importance. The patient had had no prenatal care. The last menstrual period was probably in February, 1934. The patient was admitted to the Obstetrical Service of the Cook County Hospital on Sept. 30, 1934, at 1:25 P.M., on account of a sudden sharp abdominal pain lasting for about five minutes which was followed by a moderate degree of vaginal bleeding that occurred at 10 A.M. A moderate degree of vaginal bleeding was present when the patient was admitted to the hospital. The patient had felt fetal movements the evening before, but no fetal movements since 10 A.M. She had been in good health until the above attack.

*Physical Examination.*—A well-nourished, obese, and well-developed colored female who did not appear ill. Temperature 98°, pulse 72, and respirations 18. Blood pressure 185/130. The uterus was the size of a full-term pregnancy, firm, and yet of a doughy consistency, and not tender. The fetus could not be palpated. No fetal heart tones could be heard. The maternal pulse was regular and of good quality. No signs or symptoms of hemorrhage or shock.

*Vaginal Examination.*—The cervix was lacerated; the cervical canal admitted one finger; no effacement, but evidence of blood in the cervical canal. The bag of waters was intact through which the fetal head could be palpated, although the station of the presenting part was minus four. No placental tissue palpable.

*Laboratory Findings.*—Urine: Albumin was plus three with negative microscopic findings. Sugar was negative. Albumin was negative from October 7 to the date of the patient's discharge from the hospital. On October 12, twenty to thirty white blood cells were found per field under low power. The Kahn test was negative. White blood count was 17,500 per c.c. on October 9. Vaginal smear was positive for the gonococcus.

*Diagnosis.*—Cephalic presentation, revealed accidental hemorrhage of the retractive type. Dead fetus.

*Treatment.*—A laparotomy was performed at 7:30 P.M. under ether anesthesia. The abdomen was opened by a median infraumbilical incision. The uterus was



apparently at term, firm, although doughy. Throughout the uterus were seen irregular purplish streaks. The uterus was twisted about 40 degrees to the left. A moderate amount of a serous exudate was present in the abdominal cavity. The torsion of the uterus was easily corrected, and it was incised in the midline high on the anterior uterine wall. No bleeding was present; and the walls were markedly thickened to about 4 cm., which thickness extended down to the uterovesical junction. The uterine cavity presented clotted blood, but no evidence of fresh blood.

The fetus was delivered by breech extraction. The umbilicus was clamped and cut. It was observed that the uterus did not contract and retract as is usually seen during the performance of cesarean section. The hysterotomy wound was immediately brought together and clamped with a few Allis forceps. A routine supravaginal hysterectomy was performed.

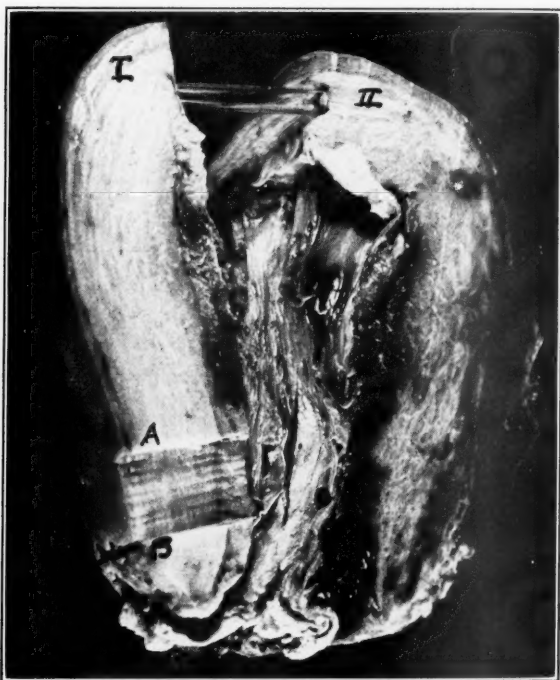


Fig. 1.—The specimen was bisected on the posterior uterine wall. *I* is the left posterior uterine wall, *II* is the right posterior uterine wall. On the left side is noted the fully attached placenta. On the right side the placenta is completely detached from the uterine wall with clotted blood between it and the uterine wall. *AB* is the section removed from the left posterior uterine wall for histologic examination.

*Pathology.*—The specimen was immediately fixed in Kaiserling's solution, and later in a formalin solution. The specimen is a supravaginal amputated gravid uterus, measuring 15 by 14 by 9 cm. On the anterior surface near the right border, there was an incision measuring 90 mm. in length. The edges were gaping and slanting downward. The greatest thickness of the uterine wall was found at the placental site which measured 53 mm. The serosa of the formalin fixed specimen was gray with many hemorrhagic areas. Many ragged pieces of a white membrane and of a brown hemorrhagic tissue were protruding from the endometrial cavity. The placenta was attached mainly to the anterior uterine wall and extended on the left side to the posterior uterine wall. The placenta was attached to the left upper and lower portion of the uterus. It was separated from the right upper and

lower portion of the uterus on the anterior and posterior uterine walls. Many blood clots were present between the detached placenta and the uterine wall. The location of the placenta was that of a placenta previa marginalis (Fig. 1).

*Histologic Examination.*—A section was removed from the left lower portion of the posterior uterine wall and its attached placenta to determine whether the placenta was attached or had slipped down from the upper uterine segment. It showed the placenta attached to the left lower portion of the posterior uterine wall.

The postoperative course was uneventful, except for a moderate degree of temperature until October 21. The abdomen was normal throughout. The temperature appeared to be due to a mild pyelitis. The patient was discharged from the hospital on the twenty-eight postoperative day.

The case reported from an anatomic standpoint demonstrates a placenta previa marginalis and an accidental uterine hemorrhage of the Couvelaire type. The author has had a number of experiences with accidental uterine hemorrhage in which cesarean section, with and without hysterectomy, was the indication in which it appeared that the placenta was probably attached in part to the lower uterine segment, but on account of the rapid separation of the placenta this feature could not be anatomically demonstrated.

The history and the clinical signs and symptoms led to the diagnosis of accidental uterine hemorrhage, although placenta previa lateralis was seriously considered. The outstanding feature in this case is the normal pulse and the abdominal findings which have been a common observation; the abnormal degree of thickening of the upper and the lower uterine segments in spite of the fact that labor had not, as yet, set in and the cervix had not undergone any degree of effacement or dilatation.

The literature characterizes the consistency of the uterus as ligneous or boardlike in accidental uterine hemorrhage. I have seen a sufficient number of these cases in which the consistency of the uterus could not be described as being ligneous. The clinical course of this type of obstetric complication has led me to adopt the classification of the contractive and the retractive types which is based on the underlying physiologic uterine changes.

The contractive type is characterized by a sudden onset of abdominal pain with early signs and symptoms of shock, evidence of marked and progressive anemia, and a ligneous uterus. On exploration the uterus is found in a marked tetanic state or ligneous uterine walls thickened to about 2 cm., and intrauterine examination discloses the presence of dark clotted and fresh blood. During the hysterotomy incision the uterine walls bleed freely. The physiologic sequence consists of a sudden abruption of the placenta from its attachment, complete or partial, and a compensatory contraction with a slight degree of retraction in the attempt to arrest bleeding from the placental site. The uterus remains in a state of isometric contraction, but owing to insufficient retraction of the placental site the maternal sinuses remain open, which permits bleeding into the uterine cavity to continue. This bleeding

continues until sufficient blood has flowed into the uterine cavity to lower the general vascular pressure. When the intrauterine pressure equals the lowered general vascular pressure, the uterine hemorrhage is arrested, but the patient is severely bled out. The shock is due to the trauma induced by the uterine tetany plus the distention of the uterus by the intrauterine hemorrhage; and if a toxemia of pregnancy is present, this constitutional state and the continued intrauterine bleeding cause a gradually increasing state of shock.

The retractive type is characterized by a more or less sudden onset of abdominal pain; the uterus may enlarge somewhat, is firm but of a doughy consistency; the anemia may be slight or absent, but there is no evidence of shock. The pulse is usually of normal or slightly increased rate and of good quality. With a slight revealed uterine bleeding, the differential diagnosis is between placenta previa and accidental uterine hemorrhage. The physiologic sequence consists of a more or less sudden abruptness of the placenta from its attachment, complete or partial, followed by a rapid and marked retraction of the upper and the lower uterine segments in the attempt to arrest the bleeding from the placental site. After a varying degree of intrauterine bleeding the placental site undergoes sufficient retraction to completely close the maternal sinuses and arrest the bleeding; and then the uterus remains in a state of isometric contraction.

Retraction is a physiologic phenomenon found only in the uterus during parturition. It consists of a certain degree of permanent shortening of the muscle fibers of the upper uterine segment during a uterine contraction.<sup>10</sup> Duncan<sup>11</sup> stated that retraction is the specific property of the uterine musculature, and is independent of the phase of a uterine contraction. In elective cesarean section, before the onset of labor, we know that retraction manifests itself in the upper uterine segment immediately as the fetus is being extracted. We note during the incision of the upper uterine segment that bleeding from the uterine wall is quite active, but as soon as the fetus is extracted, the uterine walls thicken and the bleeding is more or less arrested, which phenomenon is due to the property of retraction. In the dog the rate of retraction of the ampullae is governed wholly by the rate in which the fetus is removed. That is, in the dog not yet in labor, if a laparotomy is performed and by hysterotomy a fetus is removed from an ampullae, the retraction immediately takes place. On the basis of clinical experience with the human being and clinical and experimental experience with labor in the lower animals, I am of the opinion that the physiology of the retraction of the uterine musculature is independent of the phase of contraction of a uterine contraction. During labor the physiology of the uterus relative to the phases of contraction and retraction is usually coordinated. In uterine dysfunction the upper

and lower uterine segments may undergo abnormal synchronous retraction which will lead to a functional dystocia, but rupture of the uterus will not result.

The normal retraction of the uterus takes place during the first stage of labor and is manifested in the upper uterine segment, while the lower uterine segment undergoes some stretching or thinning which is referred to as the law of polarity. During the second stage of the labor the upper uterine segment undergoes further retraction or thickening while the lower uterine segment holds or undergoes some slight stretching or thinning until the ovoid is expelled. During the third stage of labor, we have the following changes: Immediately after the expulsion of the ovoid the uterus may temporarily relax with an arrest in the mechanism of placental separation, or, immediately with the expulsion of the ovoid the upper uterine segment undergoes excessive contraction and retraction, particularly the placental site, which is demonstrated during the performance of cesarean section with the result that the chorionic villi are separated from the placental site, followed by the formation of a retroplacental hematoma which aids in the separation of the placenta from the placental site. After the placental separation the upper uterine segment undergoes further contraction and retraction, and with a synchronous contraction of the lower uterine segment, with or without the aid of intraabdominal pressure, the placenta is expelled from the uterovaginal canal. After the expulsion of the placenta the placental site undergoes excessive retraction which keeps the maternal sinuses closed and so permits thrombosis and organization to take place. The lower uterine segment immediately after the placental expulsion is usually found in a flaccid state, but the upper uterine segment maintains its state of retraction.

In the above instances the law of polarity may be disturbed by a temporary contraction of a transverse segment of the uterus with an incoordination of the uterus above and below the zone of constriction as is seen in cases of constriction ring dystocia.<sup>12</sup> In the retractive type of accidental uterine hemorrhage, we may find retraction taking place only in the upper uterine segment, particularly at the placental site; or it may involve synchronously the upper and lower uterine segments as is demonstrated in the reported case. The clinical importance of this pathologic physiology of the uterus during pregnancy and labor will be demonstrated in a paper on the lower uterine segment.

The case reported brings up a very important etiologic factor as to what brought about the acute onset, the accidental uterine hemorrhage or the placenta previa. The specimen shows a uteroplacental apoplexy of Couvelaire and a partial separation of the placenta from the upper and lower uterine segments. It is seen that the placenta is mainly separated from the right upper and lower portion of the uterus. The station of the presenting part was minus four or high which in itself

speaks for a placenta previa, because I have observed for many years that in placenta previa the station of the presenting part is always high at the onset of the bleeding. I have never found the presenting part low in the pelvic cavity in cases of placenta previa.

The lower uterine segment is gradually elongated during pregnancy, and during the last month of pregnancy there is either a gradual or a sudden abrupt elongation of the lower uterine segment which is known as the phenomenon of "lightening" or the final physiologic phase of the preparation of the uterus for parturition.<sup>13</sup> During any phase of the elongation of the lower uterine segment the solid placenta in part is separated from the lower uterine segment which is the mechanism of bleeding in placenta previa. I believe that in this case the "toxemia of pregnancy" was of a chronic form and the placenta previa was the active cause of the onset of the signs and symptoms and was followed by a premature separation of the placenta from the right upper portion of the uterus. Yet, in retrospect with the clinical and pathologic findings I am inclined to believe that the diagnosis should be placenta previa marginalis complicated by a chronic form of accidental uterine hemorrhage.

The classification of accidental uterine hemorrhage in the contractive and retractive types is of clinical value in the diagnosis and management. In the contractive type, on account of the underlying physiologic changes, the indication must be of a radical nature in order to empty the uterus of its contents in order to combat the hemorrhage and shock. Cesarean section, with or without hysterectomy is the safest treatment for the patient. When the choice of delivery is per vaginam, and the patient is in the first stage of labor, the bag and the Spanish windlass are indicated. Before the bag is inserted some of the liquor amnii and blood should be allowed to escape in order to somewhat decrease the intrauterine tension which will permit the uterus to relax, therefore favoring contraction and retraction to overcome the state of isometric contraction which has prevented the contraction and retraction of the uterus for the mechanism of the expulsion of its contents.

The retractive type, on account of the underlying physiologic changes, may be conservatively treated in emptying the uterus of its contents. This is particularly important in a primipara. After the primary hemorrhage, the early retraction of the upper uterine segment, and particularly the placental site, brings about an arrest of further hemorrhage from the placental site. These cases can be treated with intelligent expectancy until an indication arises for radical treatment. If the patient is not in labor, then labor may be induced by medical or operative measures. It is a frequent occurrence in normal labors that with the expulsion of the placenta, we find evidence of clotted blood attached to the maternal surface of the placenta which makes us consider the possibility of a mild accidental uterine hemorrhage having been pres-



ent, but since we have had no revealed bleeding, we must consider the premise that the separated portion of the placental site was closed by retraction during the labor.

# SUMMARY

In view of the case reported with the anatomic evidence of accidental uterine hemorrhage and placenta previa marginalis being present in the reported case warrants the suggestion that the definition of this obstetric complication should be changed. The definition as is accepted makes it *specific* that the placenta must be situated above the physiologic retraction ring or on the upper uterine segment before its separation. In view of the above considerations I would suggest that accidental uterine hemorrhage should be defined as a *premature separation of the placenta*. On the basis of the physiologic changes underlying the clinical course, the author suggests the clinical designation of accidental uterine hemorrhage as of the contractive and the retractive types.

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55 EAST WASHINGTON STREET

**Wolfe, Samuel A., and Kaminester, Sanford:** Granulosa Cell Tumor of Ovary, Am. J. Surg. 31: 471, 1936.

Granulosa cell tumors of the ovary have been erroneously interpreted as atypical carcinomas, sarcomas and endotheliomas. Solid, cystic and combined forms of the neoplasm occur. The yellow color is indicative on gross examination. The histologic appearance is varied. In the epithelial types diffuse, alveolar, trabecular and cylindromatous morphology are reproduced. A sarcomatoid pattern is encountered when the cells assume a spindle or fusiform type. The Call-Exner body is distinctive. The hormone elaborated by the tumor cells causes endometrial hyperplasia and hypertrophy of the myometrium. Prolonged vaginal bleeding with or without antecedent amenorrhea is the most prominent complaint and results from endometrial hyperplasia. Vaginal bleeding, enlarged uterus and an ovarian tumor form a triad clinically diagnostic of granulosa cell tumors. Granulosa cell tumors are generally benign and in the early stages are cured by simple removal. Sensitivity of the tumor to irradiation is varied. Cases reported in the literature do not contain sufficient data to warrant a final opinion.

J. THORNWELL WITHERSPOON.

## BANTI'S DISEASE AND PREGNANCY; SPLENECTOMY; DELIVERY OF FULL-TERM LIVING CHILD SIX AND ONE-HALF MONTHS LATER

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**B**ANTI'S disease seems to be a very rare coincidence in pregnancy, and very few cases of pregnancy occurring in a patient with this condition have been reported.

Allen<sup>1</sup> reported two cases in 1924. One patient had a splenectomy five years prior to the pregnancy. The pregnancy was normal, except for gastrointestinal disturbances. Labor was terminated by low forceps; the patient suddenly died as the vagina was being inspected immediately after delivery. The second patient delivered a premature child; the delivery was followed by postpartum hemorrhage. Six months later when the patient was six weeks pregnant, a therapeutic abortion and sterilization were advised and done; one month later splenectomy was done and the spleen was found to weigh 885 gm.

Birdsong, Hubert, and Whelchel<sup>3</sup> reported a case in 1925 of severe anemia in pregnancy requiring transfusions after delivery. Diagnosis of splenic anemia was made on the enlarged spleen and liver with the profound anemia. The patient improved slowly.

Hamlin<sup>5</sup> reported a case in 1932 of anemia of pregnancy with an enlarged spleen but does not make a definite diagnosis of Banti's disease.

In 1933 Fröhlinsholz and Michon<sup>4</sup> gave a very full report of a case of anemia with enlarged spleen in a primipara of twenty-two years. The spleen reached to the iliac crest, and the liver was four fingers below the costal margin. During the last trimester several alarming epistaxes were only controlled by tight nasal packings, and blood transfusions. The only slight evidences of toxemia were slight albuminuria and blood pressure 135/75 during this trimester. She was delivered of a living infant, weight 2,880 gm., by low forceps. Although the spleen was not removed, the authors, after discussing the differential diagnosis, came to the conclusion that the patient had "Banti's disease in the so-called intermediate phase, succeeding simple splenic anemia and preceding the ascitic period. In this phase, nasal and gastrointestinal hemorrhages and urobilinuria are common manifestations." They also remark on the unusual occurrence of pregnancy in a patient with Banti's disease and state, "We have only found mention of one case, that of J. Olmer, of the coincidence of such an affection with the state of gestation."

In 1934 Ashton<sup>2</sup> reported a case of a patient developing an enlarged spleen immediately postpartum.

Hesseltine<sup>6</sup> in 1930 reported a case of Banti's disease in pregnancy. His patient was found to have an enlarged spleen and a moderate anemia when three months pregnant. A splenectomy was done at this time, the spleen weighing 600 gm. The liver was also seen to be enlarged and cirrhotic in appearance. The pathologic diagnosis was Banti's disease. The patient made an uneventful recovery from the operation and carried the pregnancy to seven and one-half months, at which time she delivered spontaneously a living child. On the eleventh postpartum day paracentesis was done on account of increasing ascites, 7,000 c.c. of ascitic fluid being recovered. The patient improved rapidly and six months later was found to be in good condition, the liver being still 13 cm. below the costal margin.

## CASE REPORT

T. R. (LCH No. 29748), white female, aged twenty-three years, first seen in this pregnancy at the prenatal clinic on Feb. 15, 1935, complaining of amenorrhea, her last menses having begun Dec. 4, 1935. This was her third pregnancy.

*Previous Pregnancies.*—1. Normal uneventful pregnancy, spontaneous delivery of full-term living child after seven hours of labor, uneventful puerperium, 1933.

2. Home delivery service (LCH No. 3614). In this pregnancy she reported to the prenatal clinic when five and one-half months pregnant. She made 10 visits to the clinic. On her first visit her blood pressure was found to be slightly elevated, 140/92, but did not rise above normal at any subsequent visit. During the pregnancy she had some headaches and dizziness and a slight edema of the ankles. Urinalysis showed slight trace to 1-plus of albumin on several readings in the last trimester. She was hospitalized for threatened premature labor on Oct. 4, 1933, for four days. At this time her hemoglobin reading was 80 per cent and red blood cells 4,300,000. She improved with bed rest and carried the pregnancy to term, delivering spontaneously after ten hours' labor a living male infant weighing 4,480 gm., blood loss 100 c.c. (est.). Immediately after delivery she drew the attention of the attendant to the mass in her abdomen, but although a mass was palpated in the left upper quadrant, its nature was not suspected. She did not return for the usual postpartum visit to the clinic in six weeks.

Third pregnancy: As stated above, she reported to the prenatal clinic on Feb. 15, 1935. At this time physical examination showed the uterus to be enlarged to about the size of a two months' pregnancy and revealed a large mass in the left upper quadrant of the abdomen. She was referred to the medical clinic and admitted to the hospital three days later.

The following history was obtained at this time: After delivery in January, 1934, she felt a mass or "knot" in her left side (as noted above). She was seen by her private physician two weeks postpartum in the treatment of acute tonsillitis. His attention was drawn to the "knot" but he dismissed it as the "ague cake" of malaria. During the next year the mass increased in size, felt heavy, and occasionally caused a dull ache, especially after exertion. She had "nervous spells" in which she had a feeling of impending calamity. She had increasing dyspnea on exertion. Her appetite was good but she noticed that cabbage, cucumbers, onions, and beans caused "indigestion" not noted previously. She was no more constipated than usual. She had no epistaxis, hematemesis, nor melena. Her friends had noticed a yellowish tinge to her skin and sclera.

She had always been healthy except for measles and mumps as a child. She had no history suggestive of malaria. One paternal aunt was said to have had an enlarged spleen but this cannot be verified.

On physical examination the patient was noted to have a large "port-wine stain" on her left cheek. The spleen, identified by the notch, was found to extend below the umbilicus. The liver was felt 5 cm. below the costal margin. The uterus was enlarged to about the size of a two and one-half months' pregnancy. Except for some carious teeth and enlarged tonsils, the physical examination was otherwise negative. Jaundice was not noted at this time.

Laboratory work, done during the next ten days, Feb. 18 to 28, 1935, was as follows: Feb. 18, 1935: Hemoglobin, 56 (Sahli); red blood cells, 2,900,000; white blood cells, 5,250; polymorphonuclear leucocytes, 75 per cent; lymphocytes, 21 per cent; and mononuclears, 4 per cent.

Feb. 19, 1935: Blood Wassermann reaction, negative.

Feb. 20, 1935: Specific gravity, serum, 1.0205; oncotic pressure, 17; serum protein, 4.8; van den Bergh, negative; urobilin, 2-plus; and icterus index, 15.

Feb. 20, 1935: Urinalysis: Color, amber; appearance, clear; reaction, alkaline; specific gravity, 1.012; albumin, negative; glucose, negative; and microscopic, negative.

Feb. 21, 1935: Fragility test, began at 0.50 and was complete at 0.36.

Feb. 23, 1935: Platelet count, 190,000; clotting time, three minutes; and bleeding time, five minutes.

The diagnosis was "splenic anemia, early Banti's disease."

After consultations among the medical, surgical, and obstetric staffs, operation was advised "in order to guard against such complications as hemorrhage from the esophagus, gastrointestinal upsets, and ascites." Operation was performed on the morning of Feb. 28, 1935, the patient being at this time about three months pregnant. It was done under spinal anesthesia (100 mg. novocaine and 10 mg. nupercaine). The abdomen was opened through a high, upper left rectus; paramedian incision swung sharply to the left just below the level of the umbilicus. This gave ample room to remove the spleen. The liver appeared normal except for a 2 by 2 mm. area of scarring at the border. A biopsy was taken including this scarred area. The gallbladder was blue and thin-walled, but three stones each about 4 mm. in diameter were felt in it. The foramen of Winslow was found partially closed by old adhesions. The pancreas was not remarkable. The stomach, pylorus, and duodenum appeared as usual, and the tips of the fingers palpated a normal pyloric ring. The appendiceal region and the lower abdomen were not disturbed because of the pregnancy. The spleen was comparable in size to a normal liver. As first seen it was half again as large as the measurements of the excised specimen will indicate. There were many fibrous adhesions laterally and posteriorly, attaching the organ to the stomach, diaphragm, colon, and tail of the pancreas. These were freed, for the most part under direct vision, with long scissors, after which it was possible to deliver the enormous notched, rubbery viscus from the abdominal cavity. The capsule was slightly thickened, and there was one deeply scarred area on the posterior surface which was hyalinized and measured about 1 by 1 cm. There were one or two other very small areas of scarring. The stomach and pancreas were carefully separated from the large veins and smaller arteries of the pedicle, and the arteries were ligated individually with No. 1 chromic catgut. The spleen was then compressed in order to return as much blood as possible into the general circulation, after which the large veins were ligated. The field was left dry. The pancreas and stomach were not injured. There were no accessory spleens.

*Pathologic Report.*—Specimen consisted of a very large, fibrotic, congested, fairly firm spleen, weighing 1,100 gm. (normal 150-200 gm.), with a nodular white thickening in one place in the capsule; and a small piece of slightly jaundiced, fairly firm liver with slightly rounded edge. Spleen showed in one section, marked hyaline thickening of the capsule, blood filled and dilated sinuses, small lymphoid follicles; in another section (from the central part of the spleen) larger lymphoid follicles, a few of which had central areas of loosely arranged epithelioid cells giving a granulomatous appearance (Gamna-Gandy nodules). Some of the vessels showed thickening. There was an increase of stroma throughout the pulp.

Liver showed some indistinctness of lobular appearance and loss of columnar arrangement of parenchyma cells, which kept, nevertheless, their normal position with respect to sinuses and bile canaliculi. Cell outlines were clear but their cytoplasm was pale staining and reticular. The Kupffer cells were several times their normal size but did not contain visible foreign material. There was very little blood in the sinuses. Around the central veins there was intracellular brown pigment, probably lipochrome.

*Diagnosis.*—Banti's disease; fatty degenerative infiltration of the liver.

The patient was given a blood transfusion immediately after operation. She made an uneventful recovery and left the hospital on the nineteenth postoperative day.

*Subsequent Course.*—She attended the prenatal clinic regularly throughout the remainder of the pregnancy. She had no toxic symptoms. Blood pressure readings

ranged 100/60 to 120/72. Urinalysis was negative for albumin throughout pregnancy. Her appetite was excellent, and she was now able to eat cabbage, cucumbers, onions, and beans without subsequent discomfort. Her only unusual symptom was moderate epistaxis occurring about once a week.

On Sept. 20, 1935 (due date by menses Sept. 11, 1935), she delivered spontaneously after thirteen hours' labor a living, normal female child, weighing 4,385 gm., with 75 c.c. hemorrhage (estimated).

On the fifth postpartum day hemoglobin was 85 per cent; red blood cells were 4,500,000. Examination on the eighth postpartum day revealed uterus and adnexa normal, a large keloid scar in the left upper quadrant of the abdomen, some flattening of the left lower chest with the left breast hanging about 2 cm. lower than the right, liver margin felt 5 cm. below the right costal margin. Puerperium was entirely normal except for one mild epistaxis. She and the baby were discharged in good condition on the ninth postpartum day.

On Nov. 18, 1935, she returned to the postpartum clinic. At this time she felt well and no changes were noted from the above examination on the eighth postpartum day. The baby was examined at the same time in the Pediatric Clinic, and found to be a healthy normal child, having gained 1,500 gm.

She was seen again on Dec. 16, 1935, when four months postpartum and over nine months after the operation. She has had no more epistaxes. Her health has been excellent except for a slight cold for the past three days.

Laboratory work done at this time showed the following: Hemoglobin, 91 per cent (Sahli); red blood cells, 4,830,000; white blood cells, 12,850 (leucocytosis may be due to upper respiratory tract infection); polymorphonuclear leucocytes, 56; lymphocytes, 39; eosinophiles, 2; mononuclears, 2; and basophiles, 1. Clotting time, three minutes; and bleeding time, forty-five seconds.

#### COMMENT

Pregnancy in a woman with Banti's disease (splenic anemia) would appear to aggravate the disease. As the uterus increases in size in an abdomen already burdened with a large spleen, abdominal discomfort and gastrointestinal symptoms occur. Hemorrhage, alarming epistaxis in one case, may occur during pregnancy and postpartum hemorrhage may be excessive. The characteristic anemia of Banti's disease may be so increased by the secondary anemia of pregnancy that hematopoietic therapy and/or transfusions may be required.

Although pregnancy seems to aggravate Banti's disease, it does not appear that the disease has much effect on pregnancy. In both early and late toxemias of pregnancy, the liver is known to be damaged; in our case the liver was seen, grossly and microscopically, to be degenerated, but the patient did not develop any evidences of a mild toxemia in late pregnancy. Other cases were similar. It seems remarkable that these women, beginning the period of gestation with known liver degeneration, showed such slight evidences of any toxemia throughout the course of the pregnancy.

Treatment of Banti's disease, at least palliative if not curative, is splenectomy; the happy outcome of ours and of the previously reported operative case would seem to indicate that as in other diseases incidental to pregnancy, the treatment is to "treat the disease, not the pregnancy."

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## BICORNATE UTERUS WITH OVARIAN, OMENTAL AND PELVIC ENDOMETRIOSIS\*

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THE report of this case concerns a white married woman, aged twenty-nine years, born in this country and occupied as a hosiery worker. Date of examination May 6, 1935. *Chief complaint:* Pain in lower abdomen during and after periods. *Family history:* Father living. Mother died of tuberculosis. Two sisters living. Two brothers and one sister died in infancy. Five sisters died of tuberculosis. *Personal history:* *Past illnesses:* Measles and diphtheria as a child. Never previously pregnant. No operation. Menstruation began at age of thirteen years, irregular, moderate amount, lasting from three to five days, always painful during and of recent years pain was worse after periods. Last menstruation April 28, 1935. *Present illness:* Seven years ago she began to have pain in lower abdomen which



Fig. 1.—Bicornate uterus with left hematosalpinx and endometrial cyst of left ovary. The left cornu is of the rudimentary type and contains a uterine cavity which is lined by endometrium not communicating with the main uterine cavity, it being separated above by myometrial bifurcation and below to the left a solid stalk of myometrium. The only opening is that which enters the left fallopian tube. The main cornu contains a normal uterine cavity continuous with a single cervical canal and affording a normal avenue of escape for the menstrual flow. The rudimentary cornu must discharge its menstrual contents through the patent left tube. Seemingly supporting Sampson's theory of endometrial propagation by retrograde menstruation and transtubal endometrial implantation.

lasted after her periods. Yellow discharge occasionally between periods. Recently abdominal pain increased in severity. In December, 1934, she was confined to bed with pelvic pain and fever; was treated for tuboovarian inflammatory disease. General physical examination: Negative. Urine and blood work negative except for an increase in blood sedimentation, twenty-five minutes, and slight leucocytosis, 9,000. Abdominal examination revealed tenderness over both tuboovarian regions with a sense of resistance over the left tuboovarian region. Vaginopelvic examination: Vulva negative. Perineum negative. Vagina negative. Cervix posterior, looks and feels normal. Body anterior, lobulated, hard, tender, slightly movable, nodule at left cornu. Right lateral region: prolapsed cystic ovary, tender. Left lateral region: tender, cystic mass independent of uterus. Rectopelvic examination revealed nothing additional.

\*Read at a meeting of the Obstetrical Society of Philadelphia, March 5, 1936.

*Provisional diagnosis:* Uterine myoma, bilateral salpingo-oophoritis, left ovarian cyst. Operation was advised and performed.

*Condition found at operation:* Omental adhesions wrapped around left ovarian cyst and left cornu of uterus, when freed, exposed cyst and small firm mass feeling

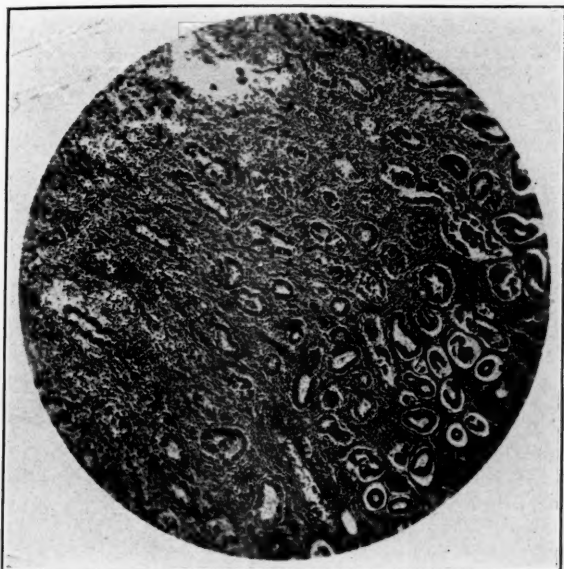


Fig. 2.—Showing endometrium of main cornu in the proliferative stage. Lining of the uterine cavity continuous with a single cervical canal.



Fig. 3.—Showing endometrium of rudimentary cornu in the proliferative stage.

like uterine fundus. The mass was grown to another mass on the midline which felt like another uterine fundus. Both uterine fundi were united by a distinct myometrial bifurcation. From the left side and at the left cornu, anterior to the origin of

the fallopian tube, the left round ligament emerged. The left tube was enlarged and distended with blood (hematosalpinx) and the fimbria agglutinated to the cyst wall. The additional or rudimentary fundus sprang from the left of the main

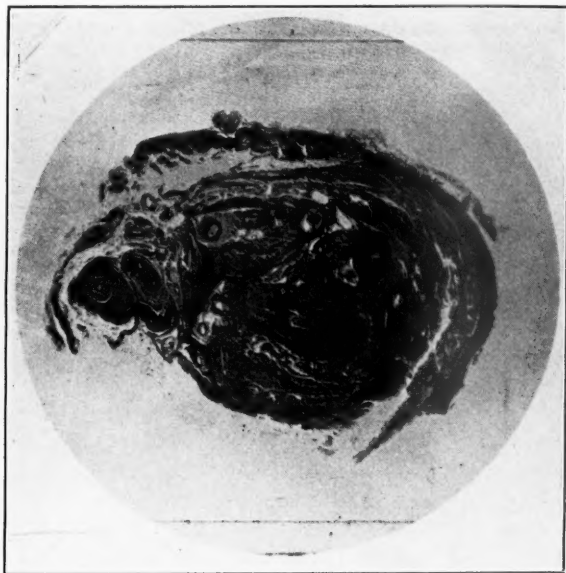


Fig. 4.—A transverse section through solid myometrial stalk by which the rudimentary cornu is attached to the main cornu. Devoid of endometrial elements.

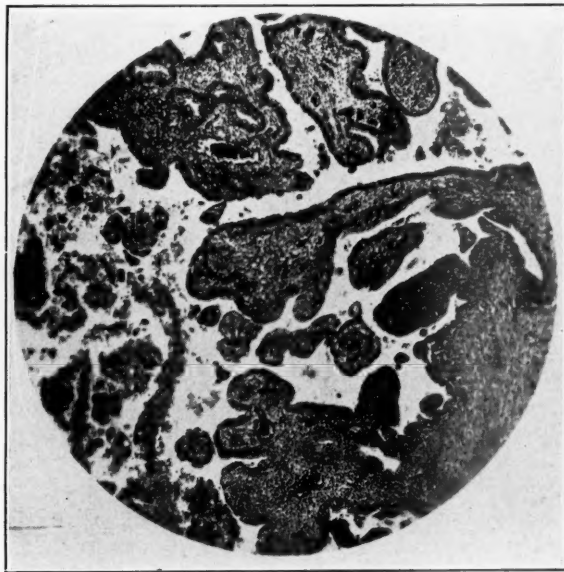


Fig. 5.—Hematosalpinx of left tube, the only escape for menstrual blood from the rudimentary cornu. Showing blood in the tubal lumen and distended mucosal plications.

fundus which was continuous with a single cervix. From the right fundal cornu, the round ligament emerged anterior to the tube which was fused with the right ovary

and adherent to the floor of the pelvis. The left ovarian cyst ruptured while freeing the omentum and exuded a chocolate syrupy material. Bluish black, glistening areas on the omentum and in culdesac.

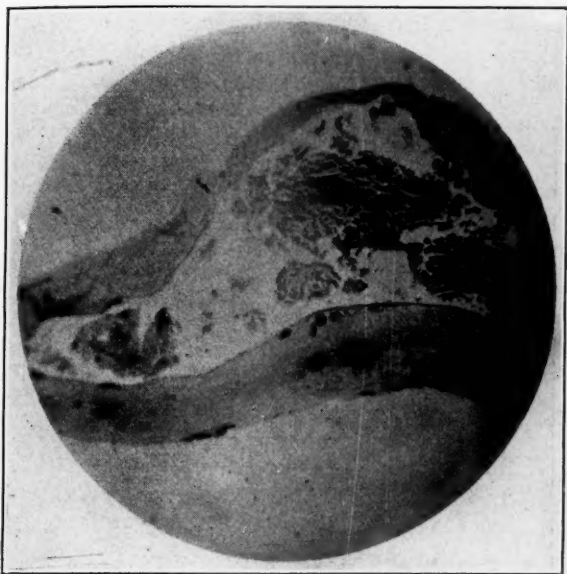


Fig. 6.—Endometrial cyst of left ovary. Showing distended and distorted endometrial glands within the cyst walls.

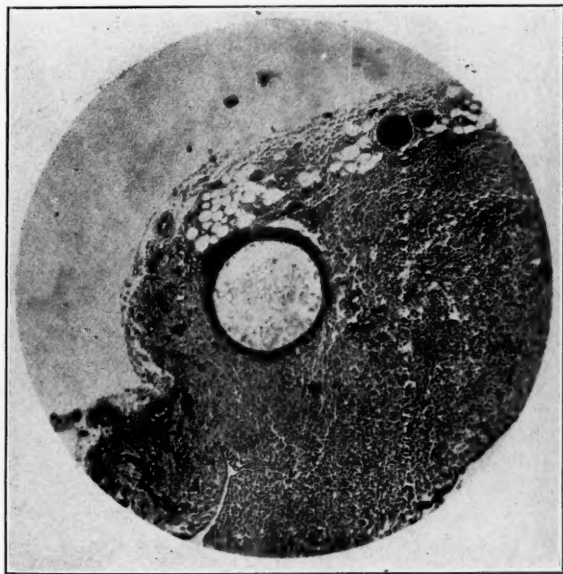


Fig. 7.—Section of omentum showing dilated endometrial gland.

*Operative diagnosis:* Bicornate uterus with left rudimentary horn, left hemato-salpinx, endometrial cyst of left ovary, omental and pelvic endometriosis, chronic right salpingo-oophoritis.

*Operation:* Total hysterectomy with bilateral salpingo-oophorectomy, resection of omentum.

*Final diagnosis:* Report of biopsy. Bicornate uterus with uterocornual obstruction on left side. Endometriomas of abdominal cavity. Phagocyte cell reaction of left tube. Abdominal blood clot and omentum.

*Comment.*—Considering the anatomic pathology, especially stressing the rudimentary left cornu with a uterine cavity lined by normal endometrium and com-



Fig. 8.—Showing several endometrial glands in a group of stroma cells, derived from implants found in the culdesac.

pletely occluded from the main uterine cavity with the exception of an opening at the uterine end of the left tube, the menstrual flow must of necessity have been retrograde and to the left resulting in the endometrial implantations, proliferating, infiltrating and menstruating in response to the ovarian hormones. Sampson's theory.

1504 MEDICAL ARTS BUILDING

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**Assinder, Eric W.: Trichomonas and Vaginal Discharge, Brit. M. J. 1: 882, 1936.**

The author stresses the frequency with which trichomonas is associated with leucorrhea, and differentiates the condition from gonorrhea. The two frequently occur together. The author advises the dark-ground condenser microscope as the most effective method of detection of the flagellate protozoa. Clinical signs are soreness, redness of vulva and vagina, with a mucopurulent discharge. Cervicitis and urethritis are present in complicated cases.

In the hands of the author the best results in treatment have been obtained with devegan tablets inserted once or twice daily, used in conjunction with an alkaline or a 1 in 1,000 potassium permanganate douche. Treatment must continue for several months.

F. L. ADAIR AND S. A. PEARL.



## BIO-ASSAY OF A GRANULOSA CELL TUMOR

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A SUFFICIENT number of descriptions of the granulosa cell tumor of the ovary have appeared in the literature to acquaint the physician with this type of pathologic lesion. Recent papers have stressed the physiologic activity of these biologically active tumors rather than their pathologic anatomy. Their endocrine function has made pre-operative diagnosis possible in many instances. This type of tumor elaborates a hormone which activates the müllerian tract in a manner similar to that of the estrogenic hormone of the normal graafian follicle.

Almost all our knowledge of the hormone of the granulosa cell tumor is of a qualitative nature. A few semiquantitative evaluations are cited in the literature.

Frank<sup>1</sup> assayed the lipid extract of a granulosa cell tumor and showed its estrogenic activity, but did not report the quantity found in the assay. Schuschania<sup>2</sup> reported that implants of the white and of the infarcted portions of a granulosa cell tumor were negative for estrogenic hormone. Extracts made from 30 gm. of the compact white cortex were also negative. Extracts of 84 gm. of the bloody infarcted tissue yielded 4 mouse units of estrogenic hormone. This yield, however, is derived more likely from the blood in the tumor than from the tumor substance, since Schuschania's value is only twice the amount found in the blood during the estrin peak in the normally menstruating woman.<sup>3</sup> Klaften<sup>4</sup> and others have demonstrated the presence of this hormone in the blood, urine, and feces in postmenopausal women who had this particular lesion.

I fail to find in the literature any studies which show quantitatively the amount of hormone in the tumor tissue proper. Such studies are necessary to increase our knowledge of granulosa cell tumor physiology. Since these tumors are uncommon and bio-assays are best done on fresh tissue, it follows that this information can be obtained through single specimen reports from scattered sources.

The object of this report is to describe a granulosa cell tumor on which was made a quantitative bio-assay for estrogenic hormone.

Patient referred by Dr. Russel Rypins. The patient was a fifty-eight-year-old white, virgin female. Uneventful menopause, aged fifty-two years. Vaginal bleeding appeared seven or eight weeks before she sought medical attention. The bleeding consisted of spotting for two weeks, after which the flow came to resemble normal menstruation. The bleeding began to subside two days before my examination. *Examination:* Senile vulva with small clitoris. Virginal introitus. Uterus normal size, mobile, with fundus anterior. A 12 cm. mass was palpable in the right iliac fossa. It was firm, nontender, globular, and fixed. A mass 3 by 4 cm. in diameter was palpable in the left adnexal region. It was firm, slightly irregular, and

appeared to be fixed. The vagina and cervix were normal except for the scanty, dark, bloody discharge which exuded through the external os. *Diagnosis:* ? carcinoma of ovaries; ? granulosa cell tumor.

*Operation.*—(July 11, 1935.) Bilateral salpingo-oophorectomy and supravaginal hysterectomy. The right ovary was found to be senile. The large mass on the right turned out to be an ectopic kidney located in the right iliac fossa.

*Pathologic Examination.*—(Dr. Margaret Schulze.) *Gross description:* The specimen consisted of the uterus which had been removed supracervically and both tubes and ovaries. The uterus measured 5 cm. in length and 3 cm. in thickness. It showed about 10 small fibromyomatous nodules in subperitoneal and interstitial locations. The endometrial cavity was somewhat enlarged. The general endometrial lining was smooth and showed some pinpoint congestion. There were 3 small mucous polyps, about 0.5 cm. in diameter and 1 cm. in length, arising near the fundus of the uterus. Arising from the left side of the uterine cavity, about 2.5 cm. above the internal os, was a large irregular polyp measuring 7 cm. in length and 3.5 cm. in its greatest diameter. This polyp had greatly dilated the internal os and protruded through it. On section it showed numerous small cystic cavities and a rather edematous stroma. Superficially it was markedly congested.

The tubes measured approximately 10 cm. in length and 0.5 cm. in diameter. No adhesions were present and the fimbriated extremity of each tube was open.

The right ovary measured 3 cm. by 1.5 cm. by 1 cm. It showed one superficial cyst. On section it was densely fibrous and showed no evidence of ovarian activity.

The opposite ovary was moderately enlarged, measuring 5 cm. by 4 cm. by 3 cm. Its external surface was smooth. On cut section it showed a rather fibrous consistency in general, with some areas showing a deep orange yellow pigmentation. These areas appeared to be more cellular than the remainder of the tissue. There were several small superficial cysts not more than 2 or 3 mm. in diameter.

*Microscopic description:* On microscopic examination the uterus showed a normal senile type of musculature with several small fibromyomatous nodules, showing the typical arrangement of fibrous and muscular tissue. The endometrium was unusually active in appearance for a postmenopausal patient. It was about twice normal thickness and showed many large irregularly shaped glands, especially in its basal portion. Their epithelium was active in appearance and contained glands with secretion. The stroma cells also more nearly approached the type found in younger patients and showed a slight amount of edema between them. A section through one of the mucous polyps showed the usual picture of irregular glands dispersed through an endometrial stroma. The large polyp showed a fibromuscular stroma in which were scattered large islands of endometrium. These endometrial islands showed an irregular glandular picture with dilatation of the glands up to 2 or 3 mm. in diameter.

The tubes showed the usual senile changes. The right ovary was small and sclerotic and showed no evidence of activity. There were a few small corpora albicantia and 2 small retention cysts with a low atrophic epithelium.

The opposite ovary showed a different picture. The stroma, which resembled normal tissue, showed areas where the sarcomatoid tumor cells merged imperceptibly with the stroma. In other areas the more epithelioid tumor cells were quite demarcated from the stroma. Here they occurred in a cylindromatoid pattern and resembled the normal granulosa cells. The picture is that of a sarcomatoid type of granulosa cell tumor with some areas suggestive of the cylindromatoid type. Nowhere was the typical folliculoid picture seen. No mitoses were found. There was no suggestion of malignancy in the histologic appearance.

*Diagnosis:* Granulosa cell tumor of left ovary (sarcomatoid), fibromyomatous uterus, senile right ovary and tubes, hyperplasia of the endometrium with mucous polyps and an adenomyomatous polyp.

*Bio-Assay for Estrogenic Hormone.*—The tissue was kept frozen for one week until the animals were ready for the tests. Accurately weighed pieces of tissue were finely minced and transplanted intraperitoneally into spayed, adult, female, white mice. Estrus was determined through examination of the vaginal spreads, using the criteria of Frank.<sup>3</sup> The yield of estrogenic hormone was found to be 3.2 mouse units per gram of fresh tissue or 36 mouse units per gram of desiccated tissue.

#### DISCUSSION

These values can only be considered as approximations due to the inherent errors of bio-assays. They only suggest an order of magnitude for stored hormone. The granulosa cell tumor, like the normal follicle, probably has a greater capacity for the production of hormones than for storage. Because of the absence of similar determinations in the literature, these values cannot be compared with those of other granulosa cell tumors. It seems likely that the different tumor types (folliculoid, cylindromatoid, and sarcomatoid) will have hormone contents which will vary with their histologic pictures. Compared with Schuschania's tumor, the tumor reported here contained at least 65 times as much estrogenic hormone as he found in the bloody portion of his specimen.

In the postmenopausal patient with a granulosa cell tumor, one has an ideal laboratory in which to work out the details of granulosa cell tumor physiology. All patients whose history and pelvic examination suggest this type of pathologic lesion should have the following assays made for estrogenic hormone.

1. Preoperative daily analyses of the twenty-four-hour output of urine and feces to determine the daily production of estrogenic hormone (assuming that an equilibrium exists).

2. Quantitative assay of the fresh tumor tissue by implants, extraction or both.

3. Postoperative daily analyses as in 1, to determine the excretion rate of estrogenic hormone.

Summary: A bio-assay of a granulosa cell tumor (sarcomatoid type) yielded 3.2 mouse units of estrogenic hormone per gram of fresh tissue or 36 mouse units per gram of desiccated tissue.

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- (1) Frank, R. T.: Am. J. Dis. Child. 43: 942, 1932. (2) Schuschania, P.: Zentralbl. f. Gynäk. 54: 1924, 1930. (3) Frank, R. T.: Female Sex Hormone, Springfield, Ill., 1929, C. C. Thomas Co. (4) Klasten, E.: Arch. f. Gynäk. 150: 643, 1932.

490 POST STREET

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#### Lin and Tsou: The Escape of Lipiodol Into the Utero-Ovarian Venous System in Hysterosalpingography, Chinese M. J. 49: 1241, 1935.

The authors report that pulmonary complications from lipiodol embolisms are not rare. The symptoms range from feeling of tightness in the chest to severe cough and even hemoptysis. The discomfort in the chest and cough were evidently manifestations of oil embolism. Hemoptysis in two of the cases reported was most probably the result of small hemorrhagic infarcts in the lungs. Dissolution of continuity of endometrium they believe offers the most plausible explanation.

C. O. MALAND.

## A NEW, RAPID, ECONOMICAL TEST FOR PREGNANCY AND CERTAIN GYNECOLOGIC CONDITIONS

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A GENERAL discussion concerning the action of certain endocrine derivatives brought out speculation as to the appearance of an anterior pituitary-like substance in the urine of pregnant women.

The idea was suggested that if a pregnant woman contained this substance in her system, she might not be sensitive to its intradermal application, and, on the other hand, a nonpregnant woman might show a reaction to its presence. Upon this basic supposition, a series of women known to be pregnant were injected and also an equal number of women known not to be pregnant were likewise studied.

The test consists of an intradermal injection of two minims of fresh antuitrin-S which has been kept in an ice box. We select the ventral surface of either forearm as the site of the injection. An ordinary 2 c.c. hypodermic syringe and 26 gauge needle is used for the intradermal injections. It is important that the skin, syringe, and needle be cleansed with sterile water and not alcohol, as alcohol reduces the potency of the antuitrin. It is also important that a true intradermal injection be made, as deeper injections are not satisfactory.

After introducing two minims intradermally, we wait one-half hour before reading the reaction. If there is a slight reaction, we wait another one-half hour before drawing our conclusions. If there is no reaction at the end of this time, we do not observe the patient longer. Patients thirty years or older delayed the reaction for a longer period, and those near the menopause reacted as late as three hours. If there is a reaction, we usually observe the reaction at the end of two hours, but this is not necessary. The reaction consists of an area of erythema around the site of injection measuring in diameter from 7 to 35 or 40 mm. Occasionally a reaction will reach 5 cm., but usually the area of erythema will measure 25 to 30 mm. If the bleb which is raised by the injection into the skin becomes red, but the skin adjacent and surrounding the bleb does not become red, then this is not a positive reaction. The reddened area overlying the bleb will measure 7 mm. or less. Obviously a negative test is one in which there is no erythema surrounding the point of injection except, as noted above, that which overlies the bleb and measures 7 mm. or less.

A patient who is pregnant or who has aborted and retains some live decidual cells, does not react to the antuitrin-S. A patient who is not

pregnant or does not have any retained living tissue of the products of conception, promptly reacts to the skin test. The reaction in a non-pregnant woman usually begins immediately following the injection or within one to three minutes. In every case that we have observed, a patient who reacts or who gives a positive skin test and negative pregnancy test has a well-defined erythema at the end of fifteen minutes, except as stated above concerning the age. Occasionally a patient who is pregnant or has retained decidual cells will react to the skin test for ten to twenty minutes, but the reaction will have disappeared at the end of one-half hour. These patients we observe again at the end of one hour and have found that their reaction does not return. In three or four instances we have observed a delayed reaction beginning four to eight hours following the intradermal injection. These patients did not react at the end of thirty minutes or one hour, and proved to be pregnant. It has also been our observation that patients who have aborted prior to admission to the hospital, and who have reacted slightly to the antuitrin-S, have very few live decidual cells on microscopic examination of endometrial scrapings. It is interesting to note in these types of cases where the decidual cells are dead or dying, the Aschheim-Zondek report will be negative, whereas the antuitrin test will be positive. If in a known abortion case we get a slight reaction to antuitrin-S, we can say, the remaining decidual cells are loosely attached. We believe there is a quantitative phase to the reaction.

The following are the case reports excepting those tests done on women entering our wards at term or in labor, all of which were positive for pregnancy, these being used as controls and checks on the solution; some thirty or forty have been done to date.

CASE 1.—Mrs. B. B., thirty-two years old. Menstruation regular. Painful, five days' duration. First menstruation at twelve years. Six weeks preceding her visit to my office she menstruated what she considered normal, excepting pain less than usual. At her next menstrual period, two weeks before, slight menstruation with severe colicky pain referred to the right side. Menstruation lasted three days, free one day, and appeared again with pain. A free period of five days again, and then she continued to stain and showed slight staining upon examination. At the time she consulted me, she was free from pain but complained of pelvic fullness and slight rectal spasm.

Examination revealed slightly enlarged uterus, cervix open. In the right broad ligament a mass the size of a walnut, very tender, and pressure caused a sense of nausea and desire to defecate. Antuitrin-S, 2 mm. skin test was made. One hour later no reaction. Diagnosis: ectopic pregnancy. Operation twelve hours later: unruptured ectopic removed.

CASE 2.—Mrs. H. B. A definite counterpart to Case 1. Antuitrin-S was negative; operation, unruptured ectopic.

CASE 3.—Mrs. L. P. Patient had pessary inserted because of sterility. Menstruation had been very painful but regular. Pessary worn three months and removed. First menstruation normal, no pain. Second menstruation missed. Five days later spotting with pain and feeling of faintness, rectal pressure. Three weeks following the missed menstruation a few small clots expressed with pain.



Examination: Mass in right broad ligament; cervix open; body slightly enlarged. Antuitrin-S three different times. Antuitrin-S negative. Patient was in hospital for observation during these tests. Diagnosis: Ectopic. Operation: Ovarian cyst size of golf ball twisted on pedicle.

By these cases our interest was awakened as to the value of this procedure in the diagnosis of pregnancy and in pelvic conditions, especially those directly influencing the ovary and the endometrium. Therefore the following series was carried out:

1. Fourteen cases of abortion, the earliest of whose pregnancy was five weeks and the latest of five months, with an average of six weeks to two months; the antuitrin-S was positive for pregnancy (negative reaction), and the Aschheim-Zondek was positive in all cases.

2. Sixteen cases of abortion, the earliest of whose pregnancy was four weeks and the latest five months (average two months); the antuitrin-S test was positive for pregnancy (negative reaction) in all cases. Aschheim-Zondek tests were not done in these cases.

3. Two ectopic pregnancies (ruptured), one of six weeks' gestation, one of two months' gestation whom we saw three weeks and two weeks following rupture; the antuitrin-S positive for pregnancy (negative reaction); the Aschheim-Zondek negative.

4. Two cases of ectopic pregnancies (ruptured), one four weeks' gestation and one two months' gestation whom we saw two weeks following rupture; the antuitrin-S positive pregnancy; the Aschheim-Zondek positive for pregnancy.

5. Four cases of abortion, the earliest two months' gestation and the latest five months' gestation; the antuitrin-S test positive for pregnancy (negative reaction); the Aschheim-Zondek negative for pregnancy.

6. Ten cases of pelvic inflammatory disease, negative antuitrin-S and negative Aschheim-Zondek. By negative antuitrin-S, we mean negative for pregnancy with positive reaction.

7. One case of hydatidiform mole, two months' gestation. Both antuitrin-S and Aschheim-Zondek positive for pregnancy. No evidence of chorionepithelioma.

8. One case of teratoma of ovary metastatic to descending colon in girl of eight years; both antuitrin-S and Aschheim-Zondek were positive.

9. One case of lymphoblastoma of brain. The antuitrin-S test was positive (negative reaction), the Aschheim-Zondek was questionable.

10. One term pregnancy with eclampsia, the antuitrin-S was positive. One term pregnancy with placenta previa, the antuitrin-S was positive. One term pregnancy with dead fetus, the antuitrin-S was positive.

11. One abortion, five months' gestation, the patient reacted positive to *B. abortus*, the antuitrin-S test was negative (positive reaction). No Aschheim-Zondek was obtained. Probably due to complete death of cells. All other *B. abortus* cases have shown death of decidual cells.

12. Three cases of abortion, the earliest two months and latest three months, all reacted to the antuitrin-S, and gave a negative pregnancy test. No Aschheim-Zondek tests were obtained in these cases. No living cells in placenta.

13. Twenty-four nulliparous patients, who were known not to be pregnant, run as controls. On these cases all antuitrin-S tests were negative for pregnancy (positive reaction). Careful history of menstrual date in controlled girls provided this material.

14. Six patients, one to eleven days postpartum, who remained positive to the antuitrin-S (negative reaction).

15. Two patients, who aborted three months prior to admission to the hospital, whose endometrial scrapings revealed dead decidual-like cells; the antuitrin-S test was negative for pregnancy (positive reaction).

In conclusion, we believe that the antuitrin-S test for pregnancy as carried out by the above method is a reliable guide in the diagnosis of gynecologic problems. To its advantages are the elements of time, simplicity, and economy. From our data apparently the test should show value in any form of pathology that would interfere with normal ovarian function, such as ovarian cyst, etc. The presence of living decidual cells will give a pregnancy test which should be valuable in diagnosis of missed incomplete abortions. Valuable time can be saved in suspected ectopic gestation. The reaction of this substance intradermally corresponds with the Aschheim-Zondek test in malignant disease. So far it has proved more delicate than the Aschheim-Zondek test in border line cases. It has shown that the antuitrin-S like substance is present in a woman's system following delivery and this may be a factor in the prolonged lochial flow, especially in older patients who do not have a sufficient amount.

#### ACUTE APPENDICITIS COMPLICATING LATE PREGNANCY

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REPORTS of acute appendicitis complicating the last trimester of pregnancy are found but infrequently in the literature. I would thus like to add the case report of a pregnancy in the eighth month complicated by a ruptured gangrenous appendix with thrombosis of the appendical vein.

F. A., a twenty-four-year-old white female, was admitted to the Newark City Hospital on May 16, 1934, complaining of abdominal pain which had begun the morning of the previous day. There had been no previous attacks of a similar nature that she could remember. The onset of the pain was followed by nausea and vomiting in several hours. The pain at first was sharp and severe, and soon became localized in the right lower quadrant. She had had a chill and thought she had had some fever. The pain later became stabbing in character, radiating to the right upper quadrant and accompanied by pain in the right shoulder. She vomited several times the night before admission. The provisional diagnosis on admission was acute suppurative appendicitis or cholecystitis with pregnancy.

Menstruation had been regular until Sept. 26, 1933, when the menses ceased. There had been no vaginal bleeding since that date. Delivery was expected the first few days in July. There had been two previous normal full-term pregnancies with spontaneous deliveries. There was no history of any miscarriages.

Physical examination showed a well-developed and well-nourished young woman, apparently acutely ill, and complaining of abdominal, right lumbar, and right shoulder pain. The eyes and tongue indicated dehydration, and there was dyspnea with slight cyanosis. Further general examination revealed no abnormal findings except in the abdomen, which was found to be symmetrically enlarged by a pregnant uterus, extending midway between the umbilicus and the xiphoid process with the fetus in the L. O. A. position. The fetal heart was strong and regular with a rate of 134 per minute. There was direct and rebound tenderness over the entire abdomen especially in the right lower quadrant. There was some tenderness in the right lumbar region. There was moderate rigidity of the abdominal muscles all over the right side. Temperature was 101.6°, pulse 134 per minute, respirations 40.

*Laboratory Data:* total white cell count 17,400 cells with 88 per cent polymorpho-

nuclears. A catheterized specimen of urine showed no albumin or sugar. There were numerous granular casts and occasional leucocytes with no clumps.

Preoperative diagnosis of retrocecal gangrenous appendicitis with thrombophlebitis was made. Immediate operation was decided upon, but she was given 1,000 c.c. of saline-glucose (5 per cent) solution intravenously because of dehydration preoperatively.

*Operation.*—Through a high McBurney incision under gas-oxygen-ether anesthesia, the peritoneal cavity was opened, revealing free purulent fluid with a colon odor which welled out of the wound. Fluid was aspirated. The uterus, which was visible on the medial side of the wound, was protected with a warm sponge. The cecum was located at a higher level than usual above the level of the umbilicus. The appendix was firmly adherent, gangrenous, and perforated, lying retrocecaly. A large fecalith had escaped from the appendix and was found lying free in the abdomen at the base of the appendix. The appendix was removed after ligating the mesentery and the base. The meso-appendix was ligated as high as possible in the hope of getting above the suspected thrombus in the appendiceal vein. An attempt made to invert the stump was not entirely successful due to the position of the cecum. Two Penrose drains were brought through a separate stab wound, one running well up under the liver, the other lying in the right gutter. The incision was closed in layers, placing several sliver drains under the fascia. The patient left the operating room in good condition. Operative time, one hour and fifteen minutes.

*Postoperative Care.*—Continuous duodenal suction was instituted through which she was alternatively given fluids and the bowel contents drained off. She was given fluid by hyperdermoclysis every six hours for the first two days. After the first twelve hours there was no vomiting. Her general postoperative course was not so stormy as might have been expected, considering the extent of the inflammatory process. Postoperative abdominal distention was quite easily controlled. On the sixth day she showed slight vaginal bleeding without pain. This was the only evidence of possible impending premature labor while in the hospital at this time. The wound drained freely of thick foul colon pus, the drainage gradually diminishing to a scant amount at the time of her discharge. The drains were shortened gradually, and finally removed on the twelfth postoperative day. She was allowed out of bed on the fourteenth day; after being up and about the ward for four days, with no apparent ill effects, she was discharged from the hospital on June 3, with the advice to go home and rest as much as possible.

Two days later, on June 5, she was admitted to the obstetric ward early in the morning, strong uterine contractions having begun about an hour previously. The membranes ruptured at 11 A.M., and she was delivered ten minutes later of a living male child weighing four pounds fourteen ounces. Following the delivery of the placenta, a moderate quantity of foul-smelling purulent material escaped from the vagina. A culture of this material and a direct smear both showed a gram-positive diplococcus. Blood Wassermann taken at the time of delivery was negative. The puerperium was uneventful except for a rise of temperature to 100.4° on the third day. She left the hospital for the second time on the tenth day postpartum. Discharge note on the obstetric record read "Premature delivery, no sepsis, puerperium negative."

She was followed in the surgical out-patient clinic for several months. There was a slight seropurulent discharge from the stab wound. During July she complained of upper right quadrant pain. A gallbladder series and a barium enema failed to show any pathology. There was no herniation of the wound. She was discharged from the clinic on Aug. 15, 1934, approximately three months after operation, symptom-free and with no drainage. Routine check-up after one year showed she was in good health. There had been no recurrence of the pain. The wound was well healed and she was apparently in good condition. The baby was well.

## IONIZATION METHOD FOR THE TREATMENT OF ENDOCERVICITIS

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**E**NDOCERVICITIS, undoubtedly a most common gynecologic condition, is very often erroneously treated. In order to evaluate properly the efficiency of the various methods of treatment, a consideration of the underlying pathology and a definite therapeutic aim are essential. In this the following must be accomplished: first, kill the invading organism; second, destroy the infected glandular tissue; and third, provide adequate drainage for the obstructed and infected Nabothian glands.

In the past few years numerous physiotherapeutic methods have been employed in an attempt to attain these aims, but to date there has been no one method which has satisfied all the criteria of rational treatment.

In general, most methods either undertreat, leaving considerable infected area, or overtreat producing tissue destruction, bleeding, necrosis, scar formation, and subsequent stenosis of the cervix. The method of treating the infected cervix by ionization is the most recently adopted procedure in the Gynecologic Out-Patient Department of Temple University, namely, ionization of metallic copper in the cervix by means of a galvanic current that meets the prescribed criteria of ideal treatment.

*Technic.*—The technic employed, as devised by Tovey,\* is as follows: The ionization apparatus delivers a direct galvanic current which is controlled by a rheostat and measured by a milliamper meter gaged to 25 milliamperes. The instrument has two poles. The negative one is attached to a specially designed indifferent electrode covered with a wet felt pad. To the positive pole is attached the intracervical copper electrode which is made in five sizes, designed to fit the cervical canal without entering the internal os. The wet felt pad connected to the negative pole is placed under the buttocks of the patient. A bivalve speculum is then introduced, the cervix exposed, and secretion removed. The proper sized copper electrode is inserted to the internal os. If the external os is too small to admit even the smallest electrode, the tip of the electrode is introduced and the negative current is turned on slowly. Five to ten milliamperes used for about five minutes causes softening and relaxation of the tissues about the external os, permitting the further insertion of the instrument. After the electrode has been properly placed, the positive current is turned on, the rheostat is turned slowly until the milliammeter registers from 8 to 20 amperes, depending upon the amount of current desired. The larger the area of the electrode in contact with the cervical canal, the greater the amount of current. After a minute or two, the electrode adheres to the cervical mucosa. Cotton is then packed against the cervix surrounding the electrode to prevent its displacement. At the end of fifteen or twenty minutes, crystals of

\*Tovey, D. W.: AM. J. OBST. & GYN. 27: 916, 1934.

copper oxychloride may be seen to surround the electrode and external os. The current now is turned off slowly, the electrode withdrawn, and the cervical canal is seen to be covered by a layer of copper crystals. Very often, due to superficial electric coagulation and dehydration of the tissues of the cervix, the electrode becomes adherent to the cervical mucosa. This necessitates the use of the negative current for two or three minutes in order to allow the withdrawal of the electrode without undue trauma to the cervical mucosa.

The patient is instructed to take a cleansing douche every night and to return in two weeks for another treatment. It has been our custom to have the patient to return immediately after her menstrual period whenever possible. Four to six such treatments are usually sufficient in clearing up the average case of endocervicitis with erosion.

Most patients have complained of some degree of cramplike pain in the lower abdomen during and for several hours after the treatment. In a few cases the pain was severe enough to confine them to bed for one day, but no other outward effects were noted. In no case has there been any evidence of bleeding or slough.

#### RESULTS

In the past eighteen months we have treated a total of 93 patients and have given 389 treatments. Of these, 71 patients were discharged as completely cured. The patient returns once in two months for a follow-up. There were 6 complete failures; these patients had a pelvic inflammatory disease with a palpable mass confusing the picture. Seven patients, after receiving the full course of 6 treatments, were relieved of the profuse discharge, but, clinically, were not cured, a definite erosion with edema of the cervix being present. Two of these patients had also a complicating pelvic inflammatory disease. Nine patients did not return after the second treatment.

Although there was no particular benefit in those cases in which there existed a pelvic inflammatory disease, there was no lighting up of infection as often occurs when the cautery is used in this type of case.

#### CONCLUSION

Our experience with this method leads us to believe that it approximates, more closely than any other thus far advocated, the ideal treatment for endocervicitis. The deposition of copper as copper oxychloride produces a marked bactericidal effect. The mild coagulating property of the positive current causes a shriveling and obliteration of the infected glands, while the technic of treatment keeps the cervix well dilated, bringing all the mucosa and the openings of the cervical glands in contact with the electrode and, what is more important, permitting adequate drainage.

2124 PINE STREET



## A MODIFIED INSTRUMENT FOR BIOPSY OF THE ENDOMETRIUM

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(From the Gynecological Service and Department of Laboratories of  
Lebanon Hospital)

THE value of the microscopic appearance of the uterine mucosa in the study of functional derangements of the female genital tract has made biopsy of the endometrium an essential diagnostic procedure. Several types of instruments have been devised for this purpose. Burch and Klinger<sup>1</sup> made use of a punch apparatus. Hoffman<sup>2</sup> employed a narrow curet. The addition of suction, as suggested by Novak,<sup>3</sup> is a distinct improvement over simple curettement, as more tissue is obtained for pathologic examination relatively free of blood. The use of a plain "open-end" cannula, also advocated by some, is objectionable because the force required to scrape off a portion of the uterine mucosa must be directed upward toward the fundus of the uterus. This is contrary to good surgical technic, owing to the possibility of perforating the uterus.

The instrument I have devised, with the technical assistance of Mr. H. Peek, of the American Cystoscope Makers, Inc., is somewhat similar to the suction-curet-cannula recently described by Novak (Fig. 1). It consists of a No. 14 F cannula (5) with a uterine curve, the end of which (a) is round and closed. On the convex side of the instrument, an aperture (b) is cut out, whose edge acts as the curet. The obturator (6) has a special coiled spring tip (j) which permits ease of introduction into the cannula and closes the aperture smoothly and completely, thus preventing any injury to the cervix when used. A pin (k) on the obturator fits into a groove in the cannula at (c), assuring complete closure of the apparatus.

For the performance of the biopsy, the patient is placed in the lithotomy position, cervix exposed with a bivalve speculum, swabbed with 0.5 per cent lysol solution, dried, and painted with 4 per cent Tr. iodine. The cervix is grasped with the tenaculum (1), and the direction and length of the uterine cavity are determined by the uterine sound (2). The cervix is then dilated with the gradual dilators (3) and (4) in order to permit the introduction of the assembled cannula beyond the internal os. This usually gives the patient some discomfort, but if done slowly and with reassurance to the patient, the succeeding steps may be performed more rapidly. The obturator (6) is removed, the Y-valve (7) installed on the end of the cannula, and the suction attachment (8) connected at (h). An assistant holds the 20 c.c. syringe and applies suction when directed.

The valve (f) is now turned toward (d), the cannula gently directed to the fundus of the uterus, and then withdrawn as far as the internal os with an upward lift, in order to exert firm pressure of the aperture (b) against the posterior uterine wall. During this maneuver, the assistant applies suction. When the syringe has been drawn out to its full capacity, the valve (f) is turned toward (e), the air expelled, the valve readjusted toward (d) and suction continued. Specimens from two or three different parts of the endometrium are taken. The instrument is then withdrawn completely while suction is maintained. The cannula, the valve, and rubber tubing are flushed out with water and their contents collected on gauze.

Continuous suction as advocated by Novak, instead of hand suction, may be used, but a bottle must be interposed in the system in order to collect the specimen.

The tissue is immediately immersed in 10 per cent formalin and sent to the laboratory for pathologic examination.

The amount of tissue obtained varies with the type of endometrium encountered. The specimen contains practically no blood and is not distorted by the suction.

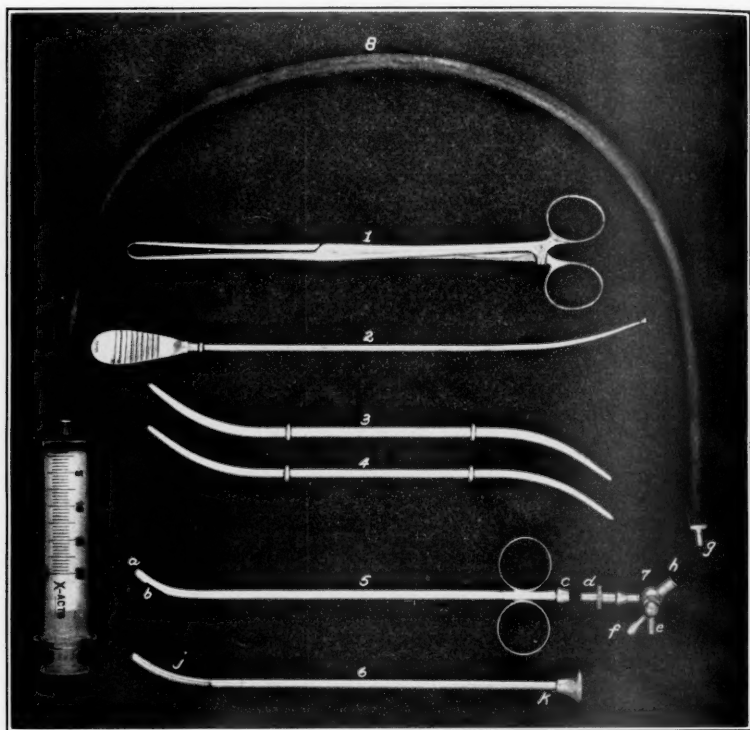


Fig. 1.

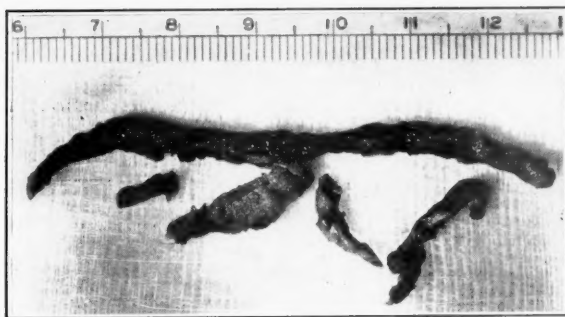


Fig. 2.—Endometrial biopsy in a case of menorrhagia taken on eighteenth day of menstrual cycle.

Fig. 2 gives an idea of the amount of material obtained by this method in a case of hyperplastic endometrium.

This method is not advocated to replace the curet. The diagnosis of suspected fundal carcinoma, uterine polyps and submucous fibroids can only be ascertained or excluded properly by a thorough curettement under anesthesia. Biopsy of the

endometrium is most useful in the study of functional amenorrhea and menorrhagia. Reasonable care should be exercised to exclude a pregnancy or an acute inflammatory lesion before resorting to the biopsy.

With proper precautions to secure sterility, the method may be adopted as an office procedure. Other than a slight bloody show for a few days after the biopsy, no complications have been encountered. With due consideration for its limitations, biopsy of the endometrium, as described above, has proved to be an efficient diagnostic procedure.

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1882 GRAND CONCOURSE

## DERMOID CYST DIAGNOSED BY X-RAY

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THE following case is unusual because the diagnosis was established before operation by the roentgen examination, which disclosed the presence of teeth in the patient's pelvis.

Miss C., single, aged twenty-four, consulted Dr. Harold A. Murphy of Jamaica Plain, complaining of pain in the right lower quadrant. The family history was unimportant. She had been well since childhood and worked steadily as a dental hygienist. Her only symptom was dull intermittent pain in the right lower quadrant, of three months' duration. The pain did not radiate, was not accompanied by nausea or vomiting, and was not related to the catamenia, which was regular and normal. An x-ray investigation of the gastrointestinal and renal tracts showed the following:

"The examination of the upper gastrointestinal tract showed that the outlines of the stomach and duodenum were normal, with no evidence of ulcer or new-growth.

"At the six-hour examination the stomach was almost empty and the head of the barium column had reached the hepatic flexure.

"At the twenty-four-hour examination the barium had reached the rectum. There was no evidence of large intestinal dilatation or obstruction. The appendix was not visualized, but the cecum was freely movable and not tender at the time of the examination.

"A study of the gallbladder region showed no evidence of gallstones, and an excellent filling of the gallbladder was obtained with the dye.

"Films of the renal tract showed no evidence of stone formation in either kidney, ureter, or urinary bladder. On the left side of the pelvis, there are several dense shadows, which have the appearance of teeth. One of these shadows seems like a fully developed cuspid tooth with a definite root canal. These are probably teeth elements in a dermoid cyst.

"Conclusions: The examination of the renal and gastrointestinal tracts showed several dense shadows on the left side of the pelvis, which appear like teeth. One of these seems to be a fully developed cuspid tooth. This points toward the presence of a dermoid cyst with tooth elements in it. Elsewhere the gastrointestinal tract is clear, with no evidence of any other pathology."

The patient was then referred to me for a gynecologic examination. The abdomen was relaxed, with no spasm or tenderness. The introitus was virginal, with

no signs of inflammation. On rectal examination a small uterus was found in good anterior position. There were no masses or tenderness in the right side of the pelvis. On the left a tender cystic mass was felt the size of a baseball. This confirmed the x-ray diagnosis of dermoid cyst of the left ovary.

At operation Oct. 16, 1935, at the Faulkner Hospital, the uterus and right adnexa were found to be normal. The left tube was intimately adherent to a cyst of the left ovary and was resected with it. An adherent retrocecal appendix was also removed. The patient made an uneventful recovery and was discharged on the twelfth day.



Fig. 1.

*Pathologic Report.*—"Gross description: *Cyst*: 8 cm. in diameter, received open. The surface is glistening. The wall measures 2 to 3 mm. in thickness. The lumen is filled with hair and greasy material. The lining in part is skin and in part is smooth and glistening. Bone and fat tissue are present in one place. One tooth is present in a pedunculated mass in the lumen. The tooth is 1 by 0.5 cm. and negative. *Appendix*: 5 by 0.6 cm. The serosa is slightly thickened and pinkish white. The lumen is obliterated. *Fallopian tube*: Negative.

"Microscopic examination: *Cyst*: The wall is composed largely of ovarian tissue. The lining surface is partly formed by squamous epithelium, and in many areas by connective tissue. Hair shafts extend into the cyst wall in places. One projection into the lumen is covered with columnar epithelium and is composed of fat and thyroid tissue. Scattered coil glands are also present. *Appendix*: The lumen is obliterated by fibrous tissue. Muscularis and serosa are negative. *Fallopian tube*: The villi are of average size and negative. The muscularis and serosa are negative.

"Diagnosis: Dermoid cyst, benign. Healed appendicitis with obliteration. Negative fallopian tube."

## TRACHEOESOPHAGEAL FISTULA AND COMPLETE ESOPHAGEAL STENOSIS OF THE NEWBORN

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NEW YORK, N. Y.

*(From the Obstetric Service of the Lutheran Hospital)*

THE case of tracheoesophageal fistula herein described presented a diagnostic and surgical problem. The pathologic findings which ultimately cleared the diagnostic situation are described below, with a diagrammatic representation of the pathologic anatomy.

Mrs. C. P., aged twenty-eight, housewife, of Italian extraction, para i, was admitted to the Obstetric Service of the Lutheran Hospital of Manhattan on Dec. 14, 1935. She had been cared for in the Out-Patient Department and her pregnancy

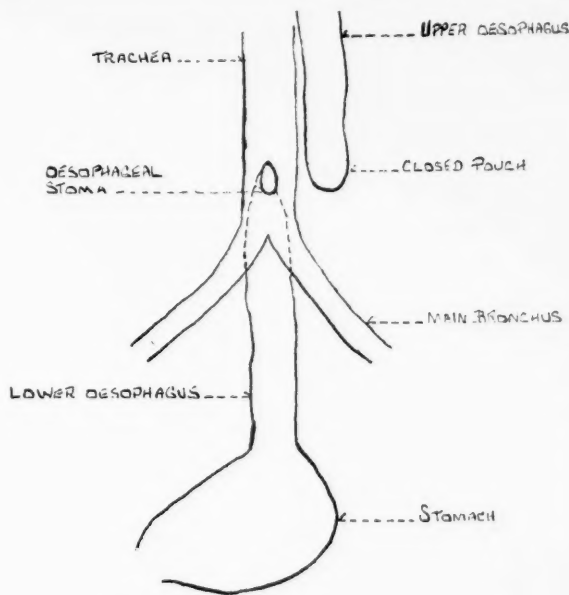


Fig. 1.

had been entirely uneventful. After twenty-four hours of false pains, she fell into active labor and after six hours delivered spontaneously an apparently normal, male child weighing 6 pounds 14 ounces. The infant was resuscitated readily. The perineum was intact, and the blood loss was moderate.

Four hours following delivery the infant was found to be moderately cyanosed, but following the administration of 30 c.c. of blood intramuscularly and brief periods of inhalations of carbon dioxide and oxygen, the color became normal. Twenty-four hours following delivery the infant again became cyanosed and all feedings were promptly regurgitated. The temperature rose to 102°. Cyanosis was marked, breathing was labored and accompanied by sounds similar to those characteristic of pulmonary edema. There were signs of consolidation over the entire right chest.



Pediatric consultation diagnosed aspiration atelectasis over the right chest. Attempts to pass a soft rubber catheter to the stomach met with failure.

A barium feeding was administered, most of which was returned by regurgitation. The plate was taken and the roentgenologist returned a report which carried the diagnosis: "Aspiration pneumonia, entire right lung; congenital stenosis of the esophagus."

The general condition of the infant was poor. Forty-eight hours following delivery cyanosis was intense, temperature 106.6°. Carbon dioxide and oxygen were administered continuously with clyses and stimulants. Feedings were continuously regurgitated. Seventy-two hours after delivery, after consultation, a Witzel gastrostomy was performed as a life-saving measure, under chloroform anesthesia. Post-operative reaction was bad and the infant died six hours after operation.

An autopsy was performed by Dr. Louis B. Ferraro. The esophagus was found divided into two distinct portions, an upper and a lower, with no connection between the two. The upper portion terminated as a blind sac to the left of the trachea and at about the level of the bifurcation. The lower esophagus ran from the cardiac end of the stomach upward behind the trachea to about 1 cm. above the bifurcation where it became narrowed from a diameter of about 1 cm., to a diameter of 3 mm., and opened directly into the trachea. The entire right lung was consolidated.

The accompanying diagram (Fig. 1) illustrates the condition as noted at autopsy. It is apparent that the sole route to the stomach of the infant was by way of the trachea. Feedings probably overflowed or were evacuated from the upper esophagus to be aspirated into the trachea, thence partially distributed to the lungs and partially to the stomach. The gastrostomy was found patent at autopsy, but with the pathology as found, it is highly improbable that it would have proved life-saving even if performed earlier.

This type of case serves to demonstrate an unusual and interesting congenital anomaly rarely seen. More important, it serves to focus attention upon the importance of complete physical and laboratory studies of the abnormal newborn and the value of necropsy where fatalities occur. More intensive study may serve to eliminate the familiar "cerebral hemorrhage," "prematurity," and other diagnoses commonly applied to the problem of the neonatal mortalities.

272 W. 90TH STREET  
509 W. 155TH STREET

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**Shelanski, H. A.:** Studies on *Trichomonas Vaginalis* in Vitro, J. Lab. & Clin. Med. 21: 790, 1936.

In studies made on artificially cultured *Trichomonas vaginalis* the following observations were made: With lethal concentrations of picric acid, silver nitrate, silver pierate, protargol, argyrol, and sodium pierate in four dilutions, viz., 1-100, 1-500, 1-1,000, and 1-5,000 in distilled water, the organisms ceased their motion, became distorted, the body membranes ruptured and the contents disappeared in the medium. With lethal concentrations of picric acid and sodium pierate, the organisms assumed a spherical appearance and the membranes burst. Freeing the organism from culture medium and suspension in Ringer's No. 2 solution rendered them more easily susceptible to the action of the substance being tested, thus demonstrating the "buffering" action of the culture medium. Comparisons were made by studying the effect of silver pierate and silver nitrate in vitro. If the separate rôle of the cation is disregarded, it was noted that silver pierate is effective at lower silver concentrations than silver nitrate. Strong silver protein shows a killing power similar to silver pierate; mild silver protein is relatively ineffective, showing its first effect at a concentration of 0.25 mg. of silver per c.c. in eight and one-half minutes.

W. B. SERBIN.

## A BABY WEIGHING FIFTEEN POUNDS TWO OUNCES AT BIRTH

H. H. SKINNER, M.D., YAKIMA, WASH.

UNUSUAL facts relating to newborn babies have been attracting considerable interest since the birth and development of the Dionne quintuplets in 1934. Twice recently attention has been directed to California by the announcement first, of the birth of an infant weighing over 14 pounds, and second, a little later a living child weighing less than a pound.

In November, 1935, I delivered a woman of a living child weighing over 15 pounds. Such a size stimulated investigation of the recorded births of large children.

The largest child on record, so far as I can learn, was reported by Dr. D. P. Belcher, Sale City, Georgia, in 1916: It weighed 25 pounds. In 1922, Dr. E. Lawton Moss, in the *British Medical Journal*, reports a stillborn female infant weighing 24 pounds and 2 ounces, which specimen is still preserved. Dr. Willis S. Cooke reports through the *Journal of the American Medical Association*, 1916, his delivery of a living male child weighing 18 pounds. In 1927, Dr. F. R. Parakh of Bombay, India, reports a 16-pound baby stillborn after a normal eleven-hour labor.

These are illustrations of different weights but not a complete record of all instances of large infants reported through journal accounts. Most of these infants were stillborn, and one difficulty seems common, in that the delivery of the shoulder always presents a problem.

One naturally turns to the large maternity hospitals and their records of the men of great experience with access to still larger compilations to ascertain their figures. No authority investigated has reported any excessively large infants. These men of authority agree that babies weighing over 11 pounds at birth are unusual, although all have witnessed personally 13 and 14 pound infants.

In view of the above, my experience seems of sufficient value to report. Mrs. J. P., aged thirty-three, of French descent, came to my office first on Aug. 17, 1935. She was a para viii. Three children were living; one died at five and one-half years, the second at eight months, and the third at three weeks. My records do not show the cause of any of the deaths. Her smallest child weighed 9 pounds. In 1929, I delivered her of her fourth baby, which weighed 13 pounds. She was in labor six hours and the delivery was not particularly difficult. The baby's cord was 42 inches in length.

She had had no operations and no illnesses. She is a very large, stout woman. In August, she weighed 300 pounds and since then, as my office scales will only register up to that amount, no further record could be kept.

Her last menstruation began "the last of February, 1935." She felt life first on July 16, 1935. Her blood pressure was 120/70, which rose gradually to 190/110 on November 16, when she showed two-plus albumin, dropping down to 150/90, and no albumin on November 19. She complained of swelling of her face, hands, and ankles beginning November 16, but her physical aspect was such that her word had to be relied upon for that condition. There was no edema present. She was so fat that when she sat in the examining chair, her abdomen extended forward to her knees.

Fetal parts could not be definitely outlined, but a little more resistance on the left seemed to indicate O.L.A. The fetal heart tones were heard on that side.

Measurements made with great difficulty from the symphysis to the upper edge of the fundus were 43 cm. Pelvic measurements were not to be considered accurate.

She went into labor in her home ten miles out in the country a little before midnight on Nov. 22, 1935, and was seen first shortly before 2:00 A.M., when she was having pains every three minutes, very hard.

Examination was made difficult by the fact that the rolls of fat from her abdomen extended to below the vulva and had to be held out of the way continually during the labor. Vaginal examination showed the large vagina full of membranes, the cervical os completely dilated and the baby's head barely engaged. The membranes ruptured during the investigation. Her pains continued about the same.

She began to bear down in about one-half hour and the baby's head was separating the vulva a few minutes later. At this time 0.5 c.c. of pituitrin was given, and her abdomen with contents which had been flopping to her left was held as near the median line as possible in order to assist the uterus in its effort to expel the baby, lest too much force be expended in merely lifting the tremendous mass to midline with each contraction.

Three-fourths of an hour later, after the baby's head had advanced nearly to the point of delivery, the mother was given  $\frac{3}{4}$  c.c. of pituitrin again, a dose which is practically never given prior to delivery, but seemed indicated when considering the probable size of the baby and the situation.



Fig. 1.—Author's case compared with a 9½ pound baby.

Shortly after this, the vulva was pushed back over the baby's head, but the shoulders did not come. Very slight traction was made on the head, slight because of fear of hanging the baby, but still the shoulders did not appear. During the pains, the Kristellar maneuver was used, but without result. Pushing up one hand by the baby it encountered the posterior shoulder, the left as it was advancing through the superior strait. By hooking a finger in the posterior part of the baby's axilla, traction was steadily maintained, at first without the slightest progress.

The baby was making attempts to breathe; consequently, once or twice the hand was removed in order to give the baby an opportunity to get some oxygen, although no air seemed to be received. Finally the shoulders made slow progression. A finger finally reached the elbow, and the baby's left hand and arm delivered, then with considerable difficulty, by rotating the posterior shoulder anteriorly, the baby's right shoulder gradually came through under the symphysis. The body and hips followed rapidly. The cord was 36 inches long and had a figure-of-eight knot in the middle. With gentle persuasion, the baby soon began to breathe, although according to the father, who said he was watching the clock, fifteen minutes had elapsed since the baby's head was delivered.

The baby appeared enormous. According to the spring scales on hand, she stretched them to 15.5 pounds. As the baby's cyanosis did not clear readily, the parents were persuaded to grant permission to take the baby to the hospital for the

administration of oxygen. At the hospital, she was again put on scales, weighing 15 pounds and 6 ounces. The circumference of her head was 37.5 cm., breadth of shoulders 21.5 cm., and length 61 cm.

Oxygen was given intermittently, and her cyanosis gradually became better, but had not fully disappeared forty-eight hours later. For several hours immediately after birth she gave short, expiratory grunts, although she cried fairly lustily.

Both arms were completely paralyzed, dangling loosely at her sides; she made no attempt to move them either voluntarily or upon stimulation. Thirty-six hours later, she moved the right arm fairly well and the fingers of the left. At this time she left the hospital.

Examination of her shoulders did not suggest any broken bones. X-ray revealed no fractures, but that her heart was enormously enlarged, principally on the right side. By estimation, it appeared to occupy one-half of the chest cavity. There were no unusual sounds heard anywhere over the cardiac region; still with the x-ray shadow and the persistent general cyanosis, the presence of some congenital heart anomaly is suspected.

The baby was seen again December 21, when she was four weeks old. All cyanosis had disappeared. A fluoroscope was not obtainable. She had attained the full use of each arm. The mother said she was careful with the left for about two weeks, when she ceased to give any particular attention, and since then the baby appeared to have normal use of both arms.

## AN IMPROVED UMBILICAL CORD CLAMP

### A PRELIMINARY REPORT

MILTON E. KAHN, B.S., M.D., F.A.C.S., BUFFALO, N. Y.

THE consistent use of a cord clamp in preference to an umbilical tie may largely avoid complications such as hemorrhage and stump infections.

Since Willson\* in 1922 recommended the use of an umbilical cord clamp, a wide variety of such instruments have appeared. The present clamp was devised in an effort to include the advantages and to remedy some of the faults of previous instruments. It has to date been used in over 200 cases without a single incidence of hemorrhage or infection. The cord stump separated on an average of 5.94 days, leaving a clean, healthy base.

The instrument† herewith presented is made of stainless steel and is extremely durable. Assembled it weighs slightly over one-half ounce. It consists of (Fig. 1) two "half-moon" stainless steel jaws connected by a hardened and tempered carbon steel spring, cadmium plated. These opposing jaws are faced with transverse, sharp, machine-cut teeth which point toward the rear of the clamp. This feature prevents the cord from slipping toward the mouth of the instrument during its application. A rectangular trough on each jaw prevents lateral sliding of the cord. On the flat surface of each jaw is a through and through window which facilitates drainage and drying of the instrument following sterilization. The two central holes admit the prongs of the applying forceps. The latter instrument is designed to permit parallel opening of the jaws of the clamp to a maximum without straining or "setting" the steel spring. Slots on the handles of these forceps provide a sure grip for the hand.

\*Willson, P.: AM. J. OBST. & GYN. 3: 506, 1922.

†Manufactured by The Gomco Surgical Manufacturing Corporation, Buffalo.  
Received for publication, April 17, 1936.

For use, the applying forceps is fitted to the clamp and its jaws widely opened. The clamp is then carried on to the cord as close to the skin edge as possible. Care should be taken to bring the cord well to the rear of the instrument. The forceps is then removed. A hemostat is then placed on the cord distal to the clamp and the cord cut between them. Ordinary cord dressing is then applied. As the cord dehydrates, the pressure of the steel spring about the thinning stump is automatically and progressively increased. As previously stated, the stump separates on an average of 5.94 days.

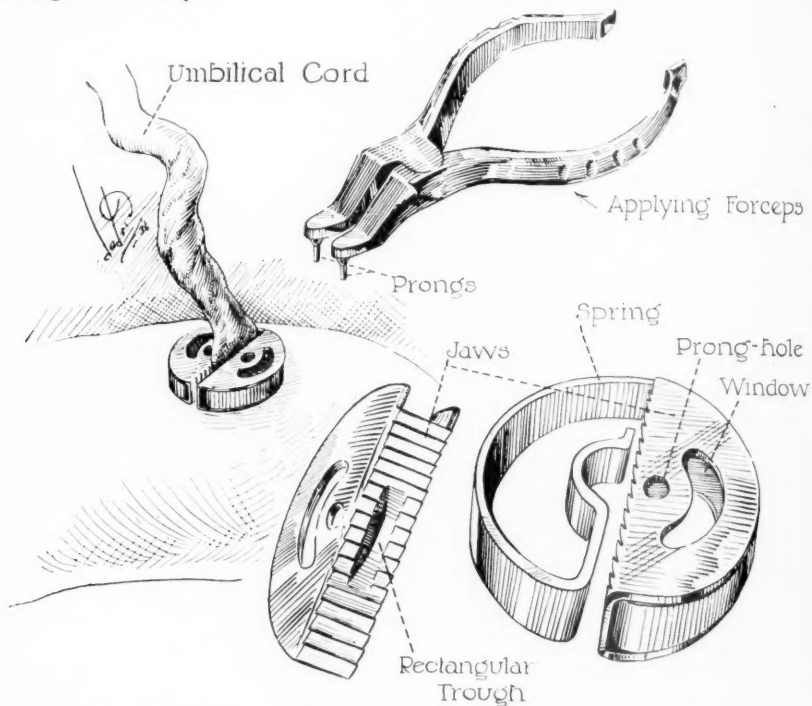


Fig. 1.—Umbilical clamp. Disassembled for detail, applying forceps, and in position on cord.

This improved umbilical clamp seems to provide an ideal method for treatment of the cord of the newborn because of these advantages: (1) It is light in weight and durable. (2) It is thoroughly and completely sterilizable, thereby reducing the likelihood of infection. (3) It is easily and quickly applied. (4) It provides a positive cord grip thereby preventing hemorrhage. (5) On separation, it leaves a clean healed stump.

40 NORTH STREET

The author is grateful to the Obstetrical Staffs of the Buffalo Hospitals for their cooperation and to Cecil Coghlan, M.B., F.R.C.S., F.R.C.P., of Sydney, Australia, for his valued suggestion.



## PALPATION OF THE FETAL HEARTBEAT THROUGH THE MATERNAL ABDOMINAL WALL\*

ROBERT J. GRIFFIN, M.D., PHILADELPHIA, PA.

(From the Kensington Hospital for Women)

PALPATION of the fetal cardiac impulse through the maternal abdominal wall is quite unknown. Fomenko reports this finding in a case of universal hydrops of the fetus. I was unable to find any other reported in the literature, although some may have escaped my search.

This apparently rare observation was made accidentally, and the following case report is given more as a matter of interest in the unusual than for any practical value it may have.

On April 23, 1933, Mrs. J. S., para iv, was admitted to the Kensington Hospital for Women in labor. According to estimate, based upon the menstrual history, she was seventeen days past term. Her pelvis was ample. Her previous labors had been easy and terminated spontaneously. On admission, she stated that she had had feeble and irregular pains for nine hours. Examination at this time showed the fetus lying longitudinally, with a rounded prominence on the left side. The head was presenting at the pelvic brim. The fetal heart sounds were heard in the left lower quadrant, and the rate was 140. Rectal examination revealed an uneffaced, soft cervix with about 2 cm. dilatation. The presenting part was not engaged. Eight hours later vaginal examination disclosed the cervix as effaced, 8 cm. dilated, and very soft. The presenting part was still above the spines. The brow was found presenting and the position was frontodextra transversa. External examination was rechecked carefully, and at this time the fetal heartbeat was found to be easily palpable through the thin maternal abdominal wall. The rate was 156 while the maternal pulse, simultaneously, was 80. The patient was prepared, and a moderately easy podalic version and extraction were performed. The baby was in good condition, weighed 7 pounds 9½ ounces, and showed the typical caput and molding, though slight, of a brow presentation.

We had here all of the conditions necessary for palpation of the fetal heartbeat through the maternal abdominal wall. The fetus was in a deflexion attitude with its left chest anterior; the membranes were ruptured, and the maternal abdominal wall was thin.

From a theoretical standpoint, in order that this phenomenon may be observed, the fetus must be in an attitude of extreme deflexion with the chest extended and pressing against the uterine wall. Also, it is necessary for the left chest to be anterior.

Since brow presentation is rare, there is not much opportunity to attempt to palpate the fetal cardiac impulse in utero in this presentation. Face presentations, however, are more common and we might some time palpate the fetal heartbeat when other favorable conditions exist, i.e., ruptured membranes and thin uterine and abdominal walls.

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Fomenko, B. P.: *Zentralbl. f. Gynäk.* 50: 231, 1926.

\*Presented at a meeting of the Obstetrical Society of Philadelphia, March 5, 1936.

## A PAD FOR KEEPING THE PATIENT DRY IN BED IN CASES OF VESICOVAGINAL FISTULA

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(From the Gynecean Hospital Institute of Gynecologic Research and the Department of Obstetrics and Gynecology, University of Pennsylvania)

PATIENTS having inoperable, vesicovaginal fistulas suffer much distress from being constantly wet. At night, the necessity of getting out of bed, in order to remove wet clothing, interrupts their sleep to such an extent that a full measure of rest is impossible. Furthermore, the heat of the body hastens the decomposition

Fenestration showing towels beneath

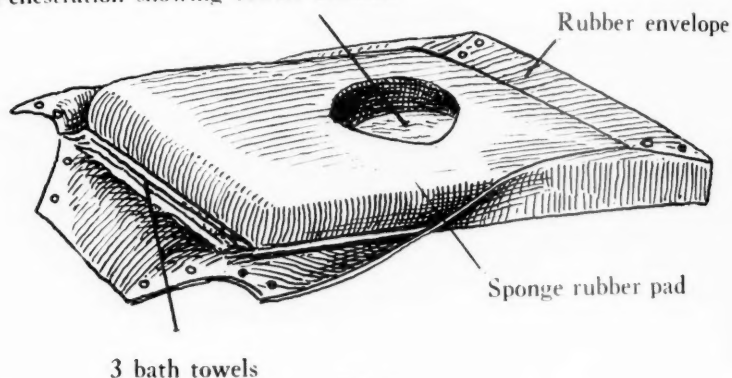


Fig. 1.

Triangular cotton pad covers

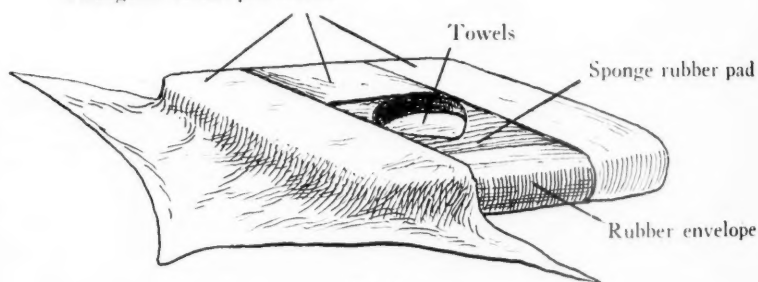


Fig. 2.

of the urine, which is absorbed by the clothing, with the production of the well-known disagreeable odor, distasteful to patient and family alike.

The device shown in Figs. 1 and 2 eliminates the above difficulties, for by its use, the patient is able to remain dry, and at the same time experiences no odor of decomposing urine.

The apparatus consists of two parts, a rubber pad and an envelope. The pad is made of sponge rubber and measures 18 by 24 by 3 inches. It possesses a centrally placed fenestration, measuring approximately 8 by 8 inches, which is somewhat the shape of a toilet seat. The sponge rubber is entirely covered by having cemented to its surface a sheet of smooth, soft texture rubber.

The envelope fits the pad, for which purpose its corners are mitered and supplied with metal snap fasteners; it is made of the same fine quality rubber sheeting as is cemented to the pad. Additional equipment includes bath towels to absorb the urine, and three triangular pieces of cotton cloth, to protect the patient's body from the rubber.

The bed is prepared for sleeping in the usual manner. Several bath towels are placed in the bottom of the rubber envelope, and upon these is laid the rubber pad. The corners of the envelope are then fastened. Next, the pad and envelope are placed across the bed with the tapered end of the fenestration toward the foot. The pad is covered by using the three triangular pieces of cotton cloth as shown in Fig. 2. The two pieces covering the ends of the pad are applied last, since they are the ones which might possibly get wet. Either of these end pieces can be removed independently, without the patient being required to get out of bed to do so. In actual practice, however, the wetting of these covers is very rare.

In order to create an even sleeping surface, patients can make themselves comfortable by utilizing pillows. The consistency of the sponge rubber pad is such that the patient is not conscious of its presence when awake, and she can assume any position during the night and still remain dry.

The patient lies with her vulva overhanging the fenestration in the pad. The urine drops through the fenestration and is absorbed by the toweling, where it spreads out beneath the pad, and thus is not exposed to the patient's body heat. As a result, no offensive odor is produced. The following morning, the moist towels are removed, the pad and envelope are cleansed with a damp cloth, fresh towels replace the moist ones, and the apparatus is again ready for use. The rubber fails to absorb any odor from the urine.

The device was developed through the cooperation of Mrs. S. M., a patient in the Philadelphia Home for Incurables, who has been using it constantly for more than two years. She had suffered from vesicovaginal and rectovaginal fistulas for more than eight years before she had the opportunity of using the present apparatus. She has found the bed pad to be the only satisfactory method for keeping herself dry at night.

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**Sharman, Albert: The Significance of Leucorrhoea, Brit. M. J. 2: 1199, 1935.**

Excessive leucorrheal discharge may arise from vagina, cervix, or uterus. The least common is the latter. Fallopian tubes are rarely the source of vaginal discharge, except in tubal carcinoma, which may cause a watery discharge.

Cervical infection is the most frequent source. Often erosions are seen, or lacerations or ulcerated and hypertrophied areas. Endocervicitis is frequent. Organisms found, excluding gonococci, are diphtheroid bacilli, coliform bacilli, staphylococci, anaerobes and gram-positive diplococci. Syphilitic or tuberculous lesions are uncommon but must be borne in mind.

The vagina is a frequent source of leucorrhea, due to infection and secondary to endocervicitis. *Trichomonas vaginalis* is the most common infective group. The discharge in this type of infection is copious, watery, yellowish, finely frothy or foamy and irritating. The vulva may be inflamed and the vaginal walls may be covered with hyperemic or granular areas.

Treatment depends on the diagnosis of the source of the discharge which must be established. A careful clinical examination is essential. Particular care must be given immediately after menstruation owing to the recurrences at this time.

In noninfective cases local treatment is useless, and general medical measures must be instituted.

F. L. ADAIR AND S. A. PEARL.

# Department of Practical Problems in Obstetrics and Gynecology

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CONDUCTED BY WILLIAM J. DIECKMANN, M.D.

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## Announcement

Beginning with the present issue, a comprehensive article on some practical topic or question will be included at frequent intervals, in each volume of the JOURNAL. While addressed primarily to the practitioner, these contributions should prove of general interest. Suggestions as to future topics are invited from our readers. This Department will be conducted by William J. Dieckmann, Associate Professor of Obstetrics and Gynecology, University of Chicago.

THE EDITORS.

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## THE TREATMENT OF PLACENTA PREVIA

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**A** VOLUMINOUS literature has accumulated on the treatment of placenta previa. A careful perusal of this literature reveals certain trends in the management of this complication. As in other medical conditions, the pendulum of therapeutic thought swings widely from one extreme to the other, but slowly and surely these excursions grow shorter, so that out of all these experiences a sane, rational and safe therapy has evolved. Few medical conditions are amenable to a specific form of treatment. Usually, the desired end-result can be achieved by a number of methods. It is thus in the treatment of placenta previa.

Although the exact nature of placenta previa was known to such early writers as Portal in 1685 and Justine Sigmundine in 1690, almost no progress was made in the treatment of this condition until comparatively recent years. A maternal mortality of 40 per cent in the expectant treatment (Müller) could be ascribed to an "act of an all-wise providence" in 1877, but an avoidable mortality of even 5 per cent bears the most careful scrutiny today. We, as obstetricians, have become mortality-conscious, partly through our own efforts and partly through the efforts of an ever increasing interest in maternal mortality by the lay public. It therefore behooves us to review the present trends in treatment and to crystallize our opinions on the best management of placenta previa.

The incidence of this complication has changed little by the passing of time, nor is it affected by race or climate. An ever increasing number of patients is referred to hospitals, so that the incidence in hospital practice has been increasing, and is much higher than in the general population. Hauch collected all the cases occurring in Denmark during the five-year period preceding 1933, and found 718 cases in over 346,984 deliveries, an incidence of only 2.07 per thousand, although this

frequency increased to 10 per thousand in hospital practice. In 12,640 deliveries at the new Chicago Lying-In Hospital from 1931 to 1936, the incidence of placenta previa was 9.02 per thousand.

It has been emphasized in the literature that placenta previa is associated chiefly with multiparity, becoming more common with increasing parity. Recent statistical studies tend to indicate that the condition is at present only twice as common in the multipara as in the primipara; 35.1 and 64.9 per cent in the Chicago Lying-In Hospital, 39 and 61 per cent in Marr's report. When one takes into consideration the size of the average American family, the present trend in incidence is equally divided between the primigravida and the multigravida. It is interesting to speculate on this change in trend. The probable explanation is the ever decreasing size of the American family, the decrease resulting in fewer mothers of high parity.

The treatment of placenta previa must be aimed at the following principles: (a) the bleeding must be arrested; (b) the pregnancy must be terminated; (c) infection must be guarded against; (d) trauma must be avoided; and (e) the patient's general condition must be maintained. The method or methods that can accomplish these results with the lowest mortality for the mother and her child should be regarded as the procedures of choice.

#### PROCEDURES USED

There is no expectant treatment for placenta previa. The opinion is universal that with rare exceptions active treatment should be instituted as soon as the complication makes itself evident. The following procedures have been advocated and used extensively in the active treatment of this condition.

1. *Manual dilatation of the cervix*, or *accouchement forcé*. This has no place in the treatment of placenta previa. It is probably the most disastrous of all the obstetric procedures for the mother, resulting in extensive lacerations and uncontrollable hemorrhage. The pathologically vascularized cervix tears like wet blotting paper when it is unduly stretched, opening up large, thin-walled sinuses. The resultant hemorrhage may be impossible to control. This procedure has no place in the present therapy of placenta previa.

2. *Vaginal tamponade*, the oldest of the methods, has few advocates today. Packing for the control of hemorrhage had many enthusiastic followers. Before the advent of good hospitals, and good roads for the transport of patients to these hospitals, vaginal tamponade may have been a life-saving measure. The method became obsolete when it was demonstrated that few cases could be packed so satisfactorily as to control the hemorrhage, that the pack as generally used acted as a plug, damming back a continued blood flow. Furthermore, many patients who survived the blood loss succumbed to the infection introduced or activated by the pack. Packing as a preliminary measure before transferring a patient to the hospital is likewise to be condemned because of the danger of infection. It should rarely be necessary to pack a patient before she is sent to a hospital.

Should packing become necessary, the following procedure can be carried out. The pack should consist of ten or twelve yards of three-inch specially prepared gauze which should be moistened just before using. Acriflavine, 1 per cent, in glycerin can be used as an antiseptic. The placenta is separated for a distance of at least 2 cm. about the os. The cervix is fixed by vulsella forceps, and the lower segment, fornices of vagina, and vagina are thoroughly packed. A vulval pad and T-binder are applied. When the course of the patient's labor indicates complete dilatation of the cervix, the pack is removed and delivery completed by podalic version and extraction.

3. *Rupture of the membranes* for the treatment of placenta previa was popularized by Justine Sigmundine in 1690. It has survived the many changes instituted in the treatment of this obstetric complication and has a distinct place in present



therapy. Rupture of the membranes accomplishes a threefold purpose. It allows the rigid placenta to remain attached to the progressively developing lower uterine segment, thereby avoiding any further separation of the placenta which accounts for the hemorrhage. The draining away of the liquor amnii allows the fetal presenting part to descend into the pelvis and to exert pressure against the placenta and the maternal sinuses, thereby controlling further bleeding. Last, it usually initiates labor. In marginal placenta previa this simple procedure is usually sufficient to control the hemorrhage. In partial placenta previa it may not suffice to control the bleeding and in such an event it represents a preliminary maneuver to be followed by another procedure which will more effectively control the bleeding. Essen-Möller reported that in 96 of 245 cases of placenta previa treated by this method, only one death occurred; Olow of Stockholm reported a mortality of 2 per cent; no deaths occurred in the Chicago Lying-In Hospital series.

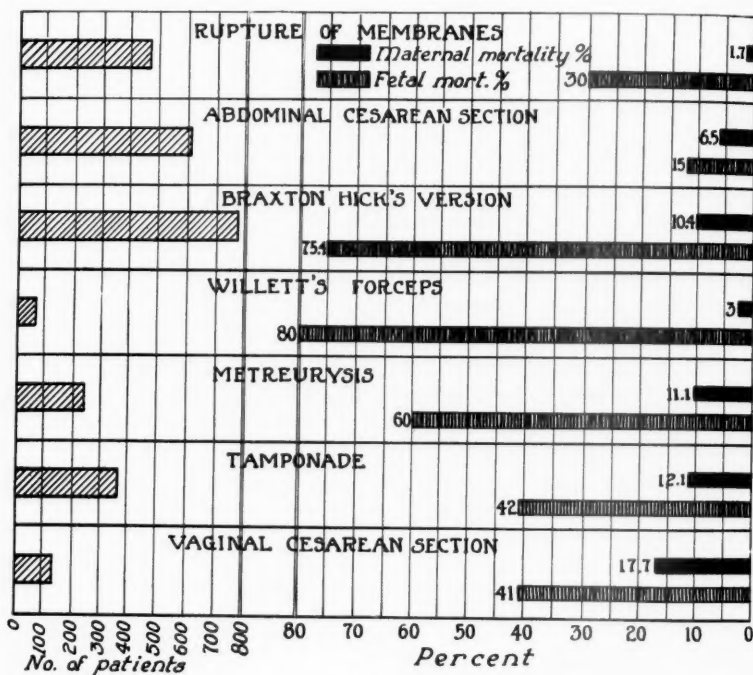


Chart 1.—Analysis of 2,631 cases of placenta previa from representative clinics.

From the foregoing and other statistics, it can be seen that in selected cases where this method is applicable and controls further bleeding, the results for the mother are good. The simple procedure can be carried out with little manipulation and with little danger of introducing infection.

4. *Braxton Hicks' version* was introduced in 1864, at a time when the expectant treatment for placenta previa resulted in a terrific mortality and the new technic represented a distinct advance in therapy. The method gained its greatest popularity before cesarean section became a safe procedure, and its use has decreased steadily with the increasing safety of abdominal delivery. The method, when successfully carried out, controls further hemorrhage effectively. The baby's body exerts adequate pressure against the placenta and lower uterine segment, providing some traction is applied to the delivered leg.

Experience has emphasized several precautions that must be taken with this method. In the first place, following the completion of the version, no attempts at

delivery must be made and a spontaneous delivery must be awaited. The only manipulation justifiable is the maintenance only of sufficient traction to control bleeding. In Hauch's statistics, Braxton Hicks' version alone without extraction resulted in a maternal mortality of 11.7 per cent; where version was subsequently followed by extraction the mortality almost doubled, 20 per cent. The increased mortality is due to serious lacerations of the cervix and lower uterine segment when the fetus is delivered through an incompletely effaced and dilated cervix. The abnormal attachment of the placenta results in a pathologic vascularization of the lower uterine segment and cervix, so that this normally elastic, tough tissue tears at the slightest manipulation, opening up enormous sinuses. This pathologic vascularization and loss of integrity on the part of the lower segment makes other methods of surgical delivery through the natural passages equally hazardous.

The procedure is a difficult operation for the relatively inexperienced physician to carry out successfully with a minimum amount of trauma and blood loss. Version, when dilatation is sufficient to introduce the hand, may be difficult, but when it is to be performed through a cervical canal dilated only sufficiently to admit two fingers, when the placenta covers the os and interferes with free intrauterine manipulation, the procedure may be exceedingly difficult. Anesthesia is usually necessary. These and other difficulties encountered are probably responsible for the marked variation in results obtained by various clinics. It is conceivable that the more experience one gains with this method, the better his results will be. Olow of Stockholm reported a maternal mortality of 9.3 per cent; Essen-Möller 7.6 per cent; Irving has had a decreasing mortality with experience and selection of cases; at the Chicago Lying-In Hospital the author reported a mortality of 1.25 per cent from 1918 to 1927; two of the three maternal deaths resulted from Braxton Hicks' version.

5. *Willett's method* of treating placenta previa is worthy of note. The procedure consists of obtaining a firm grasp of the fetal scalp by means of a modified vulsellum forceps and using this means of applying steady and continuous traction of the head. The illustration demonstrates the principle of the method. Willett's forceps are ideal for this purpose; however, a long, heavy vulsellum forceps can be substituted. The presenting part can thus be kept closely applied to the placenta, thereby controlling the bleeding. Dilatation of the cervix with normal delivery of the infant is awaited.

Although living children have been delivered by this procedure, it is preferable to confine its use to previable infants. Properly carried out, it is effective in arresting the blood flow. This method should largely replace Braxton Hicks' version in marginal and partial degrees of placenta previa because of its simplicity and the technical difficulties of the latter procedure. Should an emergency arise in the home, Willett's procedure could be carried out with a minimum of manipulation and experience. The method has had considerable vogue in Great Britain but it has been rarely made use of in America.

6. Maurer in 1887 introduced *metreuryisis* in the treatment of placenta previa. This method gained considerable popularity through the work and writings of Dührssen. The idea of introducing a rubber balloon into the lower uterine segment and distending it with some fluid medium to exert pressure appears at first hand to be a good one. The bag should be introduced intraovularly, after rupture of the membranes. Properly introduced it serves to compress the placenta against the uterine wall, effectively controlling further hemorrhage. A bag of 10 or 11 cm. in diameter across the base should be used, so that sufficient dilatation for immediate delivery is obtained on its passage. Sufficient traction should be applied to the bag to keep it closely applied to the placenta. A weight of 250 to 500 gm. attached to the bag and suspended over the end of the bed or over a pulley is usually effective. The passage of the bag is rarely followed by spontaneous delivery so that recurrent bleeding may necessitate delivery by version and extraction or by forceps.

The practical objections to this method are the following: The progress of the bag in securing dilatation must be carefully followed. Immediately after it has left the cervix it must be removed from the vagina so that it does not act as a plug behind which serious hemorrhage may occur. The passage of the bag may have to be followed by further manipulation for the delivery, thereby adding to the danger of trauma and infection. The foreign object introduced into the uterus, and often left in situ for twenty-four hours and longer, increases the incidence and hazards of infection, always a real danger in placenta previa. Sudden expulsion of the colpeurynter may result in extensive lacerations with serious hemorrhage. Last, a suitable rubber balloon may not always be available.

In that many women who were treated by metreuryxis to control the hemorrhage, subsequently had other obstetric procedures to complete delivery, it is difficult to collect statistics for the former operation alone. Hauch in his survey of Danish cases reports a maternal mortality of 12 per cent; Olow of 7.5 per cent for Sweden; Peekham of Johns Hopkins Hospital, where metreuryxis predominated in the treatment of placenta previa, reported a mortality of 8.64 for the last ten years preceding 1930. It is of interest to note that this procedure offers a better prognosis for the baby than does the operation of Braxton Hicks' version, where the baby is most often sacrificed as a tampon to control the mother's bleeding.

7. A new epoch in the treatment of placenta previa began with the introduction of *cesarean section*. The first abdominal section for this condition was performed in this country by Houston Ford in 1892. Dudley published an article in 1900 and stated that "cesarean section is the ideal treatment of placenta previa." In England this operation in placenta previa was taken up by Lawson Tait; in France by LePage; in Germany by Krönig and Sellheim in 1908. Cesarean section during these early years carried a considerable mortality even though uncomplicated by placenta previa, but in spite of this the results obtained were considerably better than with the older methods of treatment. The use of cesarean section spread slowly throughout Europe, but very rapidly in this country.

8. *Vaginal cesarean section* had considerable vogue in Germany. The method rapidly lost its popularity because of the associated high mortality. The advantage offered by this operative route, because of the decreased danger of infection, was lost in the increased danger of serious hemorrhage. All operative manipulations on the cervix and lower uterine segment, the seat of a placenta, are extremely difficult and hazardous. Hauch in his collected statistics reported a mortality of 24.1 per cent; Olow 10.1 per cent. This method has not been used extensively in any of the American clinics.

9. With the introduction of the *low or cervical cesarean section* and its increased safety, the use of abdominal delivery in the treatment of placenta previa has gained tremendous impetus. The Eighth Congress of the French obstetricians and gynecologists in 1933 carefully considered the results obtained in the treatment of placenta previa in the leading clinics of the world and concluded that abdominal cesarean section was the treatment of choice in all serious cases of placenta previa. Similar conclusions were reached by the Northern Surgical Society in Stockholm in the same year, representing Norway, Sweden, and Denmark; Essen-Möller in 1934 concluded that abdominal cesarean section was justified in all serious cases. In Germany, Mikulicz-Radecki expressed similar views.

In the United States, DeLee was the first to advocate more widespread use of low or cervical cesarean section or laparotrachelotomy in placenta previa. Bill of Cleveland extended its use to include all types of this condition. Irving, at the Boston Lying-In Hospital, has steadily increased the incidence of cesarean section in placenta previa. Johns Hopkins was the last large clinic to adopt this treatment in selected total placenta previa cases, although Williams was never thoroughly convinced that this was ideal treatment.

Theoretically, cesarean section offers many advantages in the treatment of placenta previa. The low or cervical operation invades the placental site, and although considerable bleeding may occur the entire bed of the placenta is open to inspection. Bleeding can be controlled by careful packing and suturing. Although it is rarely necessary, a bleeding sinus can be stitched. The pathologic uterine wall is not traumatized, thereby minimizing the likelihood of infection. In some cases where the placenta is attached to the anterior wall of the lower segment, necessitating extensive laceration of the placenta before the uterine cavity is entered, a low classic section may be preferable. Some authors advocate the routine use of the classic section for placenta previa, thereby avoiding the placenta and its site. The greater security of the low operation from postoperative complications, however, usually outweighs the increased difficulties encountered in its performance in placenta previa.

Although the low or cervical cesarean section provides considerable safety from infection, its use in the obviously infected case is not advisable because of the likelihood of a serious extension. Patients who present themselves with obvious infection as a result of previous manipulation, packing, or mismanagement, had better be treated by conservative methods. Porro cesarean section, or cesarean section followed by hysterectomy, has received increasing popularity in these cases. Many patients are multiparas, when the operator need not be too greatly concerned by the sacrifice of the uterus. The careful surgical removal of the large infected uterus, often the focus from which the general infection develops, results in a decreased incidence of serious, postoperative puerperal infection.

The maternal mortality of cesarean section in the treatment of placenta previa differs greatly, and is largely determined by the cesarean section mortality of the clinic and the class of patients treated. At the Chicago Lying-In Hospital we have delivered 120 patients with serious degrees of placenta previa without maternal mortality. Bill of Cleveland has reported equally good results. Large series of cases have been reported in which the mortality is as high as 10 per cent; Hauch's was 9.7 per cent; Pankow's 4.4 per cent. The maternal mortality is largely the result of a general infection superimposed on a patient so seriously depleted of blood that she offers little if any resistance.

TABLE I. CHICAGO LYING-IN HOSPITAL STATISTICS

JANUARY, 1927, TO JANUARY, 1936

<i>190 Cases of Placenta Previa</i>		
MARGINAL 99	PARTIAL 25	TOTAL 66
<i>Methods of Treatment</i>		
	NO. OF CASES	PERCENTAGE OF CASES
Low or cervical cesarean	80	46.5
Porro cesarean	8	
Vaginal cesarean	1	
Rupture of membranes	32	16.8
Metreuryasis	28	14.7
Braxton Hicks' version	23	21.1
Breech extraction	8	4.2
Forceps delivery (only)	11	5.7
<i>Mortality</i>		
MATERNAL	FETAL	
None	Total	64 or 33.6%
	Previa and monstrosities	48
	Viable normal	16
	Corrected mortality	8.4%

## PRINCIPLES OF TREATMENT

In the preceding brief résumé of the various treatments advocated in placenta previa, the tendency toward a more rational therapy can be noted. No one method offers the ideal solution for every case because of the many factors involved, such as the degree of placenta previa, the patient's condition, her parity, the duration of the gestation, the patient's environment, and the attendant's skill. These and other variable factors influence greatly the therapy and its ultimate result. Thus we see that in spite of an accumulated experience of years in thousands of cases, our collected results still warrant improvement. Munro-Kerr reports that the maternal mortality in England and Wales is 14.11 per cent; in Scotland 11.9 per cent; the U. S. Children's Bureau reported that 11 per cent of maternal deaths resulted from hemorrhage. According to the 1934 Report on Maternal Mortality in Philadelphia, 8.7 per cent of the deaths resulted from placenta previa.

In recent years the importance of other factors than the mode of delivery has been repeatedly emphasized. Early recognition and treatment of the condition, hospitalization, proper preparation of the patient before delivery, and free use of blood transfusion are probably of equal importance as the method of delivery.

*The ideal management of placenta previa* should begin in the prenatal period. The patient's history should include information concerning any hemorrhage in previous pregnancies. The patient should have a careful blood study. Anemic patients should receive adequate therapy during the pregnancy for the restoration of the normal blood picture. There has been an increase in the anemias of pregnancy during the last economic depression. At the Chicago Lying-In Hospital 12 per cent of pregnant women had a hemoglobin of less than 10 gm. per 100 c.c. of blood. Patients with a very low hemoglobin should be transfused before delivery. It requires little discussion to emphasize the fact that the anemic patient will withstand a moderate blood loss poorly and a serious blood loss not at all. To carry modern prenatal care a step further, the doctor in the smaller community where medical facilities may be somewhat limited, particularly in an emergency, would do well to determine the patient's blood group. In this age of prophylactic medicine he can even go a step further and group and match the husband or some other members of the family. Thus, when an emergency arises, a safe blood donor is immediately at hand and precious minutes are saved. Fewer serious mistakes will be made under the stress of pressing events.

Bleeding during pregnancy at any time must be considered abnormal and of sufficient importance to warrant investigation. Patients must be taught to report any bleeding occurring during gestation. When the bleeding occurs during the last trimester of pregnancy, it should be regarded of sufficient import to merit an examination, in a hospital if possible. In the literature which has been reviewed, several impressions stand out vividly. In the first place, placenta previa is a complication necessitating hospitalization. Only under unusual circumstances is it justifiable to treat a patient in the home. In the second place, women should be referred to a hospital with their initial bleeding without manipulation in the home. To obtain any improvement in our results, these two fundamental principles must be observed.

The initial hemorrhage in placenta previa is rarely alarming. The characteristic course is small, repeated hemorrhages, and finally a serious hemorrhage. These small hemorrhages are the warning signs of a serious calamity. The patient should be referred to a hospital for diagnosis and treatment at the first sign of bleeding in the last trimester. This regime will rarely necessitate examination in the home with its possible complications.

Examination of bleeding cases in the home is always fraught with danger. A simple examination for diagnosis may stir up a profuse hemorrhage necessitating further manipulation for its control. Packing for the control of bleeding adds



greatly to the danger of infection and is often ineffective in controlling the bleeding. These manipulations for diagnosis and control of hemorrhage often alter the subsequent course of treatment and make a favorable prognosis unfavorable. The patient who is referred to a hospital at the earliest sign of bleeding will rarely be jeopardized by the transportation, if she has not been previously examined.

The maternity department of every hospital should have a smoothly functioning regime for the treatment of bleeding cases. Indeed, in some of the foreign countries, special centers have been set up for the treatment of patients bleeding in pregnancy, in an effort to lower the high maternal mortality. The patient, on entering the hospital, should have her blood group determined and her blood should be cross-matched with that of a suitable donor. Examinations of all kinds are usually postponed until a donor is available, for once an examination is done, the appropriate therapy must be instituted. The patient who has lost considerable blood and shows the general effects of the blood loss should have a preparatory transfusion. This will fortify her against an unusual blood loss during the subsequent diagnosis and treatment. Bill first pointed out the value of this procedure, which we have adequately confirmed at the Chicago Lying-In Hospital.

Before the vaginal examination is started, preparations should be completed for obstetric procedures from below or possible cesarean section. The degree of previa is determined as well as the state of the cervix, the size of the pelvis and the maturity and size of the fetus. We distinguish clinically, *marginal placenta previa* where the edge of the placenta is palpable at the cervical os, *partial placenta previa* where a portion of the os is covered by placental tissue, and *total placenta previa* where the entire os is covered by placenta. The degree of placenta previa is determined when the patient is first seen, irrespective of the dilatation of the cervix. In that most cases are examined and treatment instituted before the advent of labor, it is not feasible or necessary to determine the placental location more accurately. The maturity of the fetus is estimated, and its extrauterine viability considered for this may effect the procedure to be followed. The examination concluded, appropriate treatment is instituted depending on the exigencies of the case.

It is rarely desirable to postpone the termination of pregnancy in placenta previa. The initial hemorrhage is usually followed by repeated bleedings, any of which may seriously endanger the patient's life. With the slow development of the lower segment more and more placenta must be separated from its attachment and hemorrhages will continue. The presence of blood in the vagina predisposes to infection by a change in biologic relationships. Necessary subsequent manipulations become more hazardous in the presence of a virulent bacterial flora. These real dangers make the policy of "watchful waiting" for viability of the baby undesirable, except under unusual circumstances, and then only with the patient most carefully observed in a hospital. This policy must result in a necessary sacrifice of previable fetuses.

The treatment instituted will depend on the many factors previously discussed. Marginal placenta previa and partial placenta previa in multiparas in good condition can best be treated by simple rupture of the membranes. Where this does not control the bleeding, one of two procedures can be instituted: Braxton Hicks' version or metureuysis. Where the fetus is previable, a careful Braxton Hicks' version is probably the treatment of choice, although its performance may be difficult. The use of Willett's method should be considered. The careful intraovular introduction of a suitable bag, large enough to provide sufficient dilatation on its passage, is preferable where the fetus is viable. It is probably a more simple procedure than Braxton Hicks' version but demands more careful and intelligent observation for a satisfactory result. Following the passage of the bag through the cervix, a spontaneous delivery can be awaited if there is no bleeding, or delivery can be accomplished by version and extraction, or when the head is engaged, by forceps.

The management of the third stage of labor is worthy of some comment. Following the delivery of the baby, normal separation of the placenta can be awaited unless bleeding occurs. In that event careful manual removal is indicated. In the event a difficult operative procedure has taken place, a careful examination of the entire lower uterine segment and inspection of the cervix for lacerations should be instituted. Lacerations which cause bleeding should be repaired. Atony of the uterus following placental expulsion necessitates careful exploration of the uterine cavity, evacuation of clots, and oxytocic drugs. If the bleeding continues, the uterine cavity should be firmly packed, packing the corporeal cavity first and then the stretched, traumatized, bleeding lower segment, and finally the entire vagina. An insecure or improperly placed pack is worse than none at all, for it acts as a plug behind which bleeding continues. It is good practice to administer pituitary extract intramuscularly or better yet, ergonovine intravenously, just as the baby is being delivered, thereby hastening the third stage.

Cesarean section should be reserved for the patient with total placenta previa; in the partial placenta previa when the placenta covers a considerable portion of the cervical os and the patient is a primipara; any patient that enters the hospital exsanguinated and in critical condition; where some other indication than the placental location exists, such as a borderline pelvis or an elderly primipara. The low or cervical cesarean is probably the preferable procedure unless the placenta is palpated during operation on the anterior wall, then the low classic is probably the simpler procedure. Porro cesarean should be considered in early multiparas with partial or total placenta previa, who are grossly infected due to previous manipulation.

It cannot be too strongly emphasized that measures for combating blood loss are a most essential part of any treatment of hemorrhage in pregnancy. The subsequent maternal mortality, serious puerperal infection, and prolonged convalescence and invalidism can be greatly reduced by a serious attempt to restore in some measure the blood loss of the patient. For maintaining blood volume, saline or Ringer's solution can be given by hypodermoclysis, using 16 gauge needles. Glucose solution in 20 per cent concentration should be given intravenously at as slow a rate as possible, discontinuing its administration just as soon as blood is available. No more than 500 c.c. should be given unless a liberal blood transfusion follows. It must be remembered that large amounts of hypertonic glucose solution draw liberally on the fluids in the tissues and increase blood coagulation time. In the event blood is not immediately available 500 to 1,000 c.c. of 6 per cent acacia can be slowly administered intravenously. Although the blood volume be restored, sufficient circulating hemoglobin must be present to carry on the vital functions of life. The amount of the transfusions should depend on the blood loss, averaging 600 to 800 c.c. in the usual case. Dieckmann and Daily report that in 22 cases in which the blood loss was measured it averaged 824 c.c., and these patients received a total of 29 transfusions averaging 670 c.c. of blood per patient.

Throughout this discussion little has been said concerning the interests of the baby in the management of placenta previa. This condition is a maternal complication and of such serious import that the mother's interests must be considered first and guarded always. The baby's interests must always come secondary in any decision. The treatment which assures a living baby and at the same time safeguards the mother's life is certainly to be preferred.

Placenta previa carries with it an inevitable fetal mortality. This condition frequently manifests itself so early in the course of the gestation that the baby could not carry on an extrauterine existence regardless of the method of delivery. In our series 10 per cent of the pregnancies were terminated before the thirtieth week, and these previable fetuses had no chance at survival; another 10 per cent were terminated before the thirty-fifth week with only a fair chance at survival. Some of the

fetuses succumb as a result of separation of the placenta and a deficient circulation, others become exsanguinated by traumatic lacerations of the placenta as a result of operative manipulations, but the majority sustain fatal injuries during their delivery.

That the fate of the infant depends largely on the method of treatment can be seen from the following figures. When the treatment consisted of rupture of the membranes, the gross fetal mortality was 33 per cent; metureyris, 50 per cent; Braxton Hicks' version where the infant must of necessity be disregarded, 54 per cent; in cesarean section, 12 per cent. Thus, it is brought home to us that cesarean section safeguards the interest of the baby the most. By this method many babies at the borderline of viability are delivered uninjured and take up a normal extra-uterine life. The tremendous increase in the safety of the baby given by this method over other methods in vogue has been a powerful argument used by many clinicians who propose to widen the scope of this treatment. The ever decreasing size of the family has resulted in an ever increasing value of the unborn baby.

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5848 DREXEL AVENUE

**Berger, Louis, Vallee, A., and Vezina, C.: Genital Staphylococcic Actinophytosis (Botryomycosis) in Human Beings, *Arch. Path.* 21: 273, 1936.**

True botryomycosis, a veterinary pathologic entity found in the horse, cow, sheep, and pig, is only very rarely seen in the human being. In the botryomycotic lesions, the organisms were supposed to be mycotic elements akin to actinomycosis. It was later demonstrated that botryomycotic lesions are of a staphylococcus nature. Until this case appeared, there were only four cases of this sort reported in man, all associated with osteomyelitis. The patient was a woman aged fifty-three, with a tumor in the posterior part of the left labium majus. The tumor increased in size and a specimen was removed for biopsy and cultures made. The culture showed *Staphylococcus aureus* and *B. coli*. The process persisted for twenty months and resisted all forms of treatment, including x-ray. The lesions were inflammatory and were identical with those described in animals. The coexistence of *B. coli* within the granules was a heretofore unknown feature.

W. B. SERBIN.

# Department of Book Reviews

CONDUCTED BY ROBERT T. FRANK

## Review of New Books

### Obstetrics

*Antenatal and Postnatal Care*<sup>1</sup> is a concise, practical, and substantial book, written with the purpose of providing, in the author's words, "instruction in the more recent advances in antenatal care and . . . the methods used in its practice," and presenting specifically the teaching of the University College Hospital in London. The book covers its field adequately, including chapters on the history and development of antenatal care, the clinic and its equipment, examination of the patient, the diagnosis of early pregnancy, hygiene of pregnancy, influence of the emotions on pregnancy and parturition, maturity, and postmaturity with more or less special reference to forensic medicine, abnormal presentations and positions, multiple pregnancy, abnormalities in the quantity of amniotic fluid, hemorrhage in early pregnancy, antepartum hemorrhage, contracted pelvis and disproportion, uterine displacements and pregnancy, vomiting in pregnancy, preeclamptic toxemia and eclampsia, disorders of the digestive, circulatory, nervous, endocrine, respiratory, and urinary systems during pregnancy, affections of the skin in pregnancy, tumors complicating pregnancy, labor and the puerperium, venereal diseases in pregnancy, and postnatal care. There are in addition six appendices including sample clinic record sheets, technic for medical induction of labor, diets, and a discussion of the conduct and scope of antenatal clinics. There are also an excellent bibliography and a fairly complete index. The book is well illustrated.

Representative chapters on the important topics of placenta previa, contracted pelvis and disproportions, vomiting in pregnancy, and preeclamptic toxemia and eclampsia are of particular interest. For placenta previa, or suspected placenta previa, the author advises conservative treatment, excluding even vaginal examination in the hospital if the bleeding is slight and the patient not in labor. For more severe bleeding, the active treatment familiar in this country is recommended, including full preparation for immediate transfusion and cesarean section before a vaginal examination in the operating room is done. Cesarean section is the treatment of choice if the os does not admit a finger; if the os admits two fingers and the placenta completely covers it; if a live child is particularly desirable, as in elderly primiparae; in the presence of disproportion or other serious complication; in patients treated expectantly in whom there is evidence that the placenta overlaps the internal os, the section being done as soon as the patient reaches the thirty-sixth week of pregnancy; and occasionally in patients whose condition is so critical that vaginal manipulation is deemed likely to cause a further fatal hemorrhage. In the cases not treated by cesarean section the choice may include Willett's scalp traction forceps with 1.5 pounds weight attached, pressure by the half breech on the bleeding point, rupture of membranes and tight binder, but never the De Ribes' hydrostatic bag.

<sup>1</sup>*Antenatal and Postnatal Care*. By Francis J. Browne, M.D., D.Sc., F.R.C.S. (Edin.), F.C.O.G., Professor of Obstetrics and Gynecology, University of London, etc. With 58 illustrations and 480 pages. J. and A. Churchill, Ltd., London, 1935.

Contracted pelvis are classified strictly after Caldwell and Moloy, treatment taking the form of cesarean section, trial labor, or induction of premature labor. Section is advised if the conjugata vera is under 3.25 inches in a flat, or 3.5 inches in a generally contracted pelvis and in most elderly primigravidas with contracted pelvis unless there is no disproportion. With respect to trial labor the author says, "A fair trial of labor can only be said to have been given when good pains have been recurring every four or five minutes for at least two hours, during which the cervix has been fully dilated and the membranes ruptured." As the author points out, "induction of premature labor for contracted pelvis is a peculiarly English method of treatment, and has never found much favor in American or continental clinics." Labor is induced after the thirty-fifth week, following a sterile vaginal examination, by instrumental means as a rule. Gum elastic bougies, stomach tubes, hydrostatic bags, balloons, or glycerin-filled animal bladders are generally used. Artificial rupture of the membranes is not allowed.

Vomiting in pregnancy is resourcefully discussed, the methods employed in treating true hyperemesis gravidarum apparently differing little from those used in this country, although the indications for termination of the pregnancy are perhaps slightly less exacting. Emphasis is placed on the importance of liver damage in this condition, and jaundice of a mild degree, or even slight bilirubinuria is regarded as a grave prognostic sign.

The management of preeclamptic toxemias and of eclampsia also accords in general with the usual view in America. Early recognition of an impending toxemic state is stressed, as would be expected in a book on prenatal care, but a full discussion of the whole topic of toxemias is given, the author endorsing the opinions of Stander and Peckham regarding the outlook in chronic nephritis.

Dr. Browne's book is readable, well informed, and discriminating in its dogma. It is a contribution of importance in a still somewhat neglected field.

FRED L. ADAIR.

*Abortion, Spontaneous and Induced*<sup>2</sup> by Taussig is a most important contribution on this subject. It is one of a series dealing with medical aspects of human fertility sponsored by The National Committee on Maternal Health. The purpose of the book is to help the practitioner and specialist in the diagnosis and treatment of abortion, as well as to inform the sociologist and student of public health of the facts necessary to understand the way in which abortion undermines the physical well-being and moral integrity of the community.

The statistics on abortion, no matter how carefully compiled, are inaccurate. Taussig, after most thorough study of the world literature, concludes that 1 abortion occurs in every 2½ confinements. This signifies some 680,000 abortions annually in the United States, of which approximately 4,000 prove fatal. An interesting chapter of the book is devoted to abortion in animals by W. L. Williams. In the cow and in the mare abortion can be induced by squeezing out the corpus luteum through the rectum. Causes for abortion in animals, and this plays a huge economic rôle in every country by reducing the fertility of herds, can occur through too frequent coitus, by the covering of too young animals, and particularly in goats, sheep, and swine through the *Bacillus abortus*. In cows, Williams is by no means sure that the bacillus plays as great a rôle as has been ascribed to it. Here the venereal infection of cattle is most important.

Only the briefest survey of the contents of this book of 536 pages can be given. The author discusses the anatomy and physiology of early pregnancy, the pathology of abortion, the causes of spontaneous abortion, both ovular and maternal, the

<sup>2</sup>*Abortion, Spontaneous and Induced*. Medical and Social Aspects. By Frederick J. Taussig, M.D., Professor of Clinical Obstetrics and Gynecology, Washington University School of Medicine, 536 pages. Illustrated. The C. V. Mosby Co., St. Louis, 1936.



exciting causes. In the discussion of the prevention of abortion, I note that no mention of progestin is made. Taussig advises extremely conservative treatment of septic abortion. He approves, however, of the emptying of the uterus if the temperature has remained normal for three to five days, then advises delayed emptying. Perforation and other complications of induced abortion are described in detail. The indications for therapeutic abortions are thoroughly entered into and the author's point of view is sane and conservative, particularly in abortion for tuberculosis where he emphasizes that economic reasons must be fully considered as tuberculosis is such a long-drawn-out disease. The technic of abortion is likewise dealt with.

The chapter on statistics on abortion throughout the world is of great interest and importance. The theological and ethical aspects of induction, a full description of legalized abortion in the Soviet Union where the mortality is only 1/100 of that of the German rate, which of course includes clandestine abortions in that country, is included.

The final chapter deals with the legal aspects of induction of abortion in various countries and states, as well as a summary of the statutes relating to abortion in the various states of our Union.

The book is copiously illustrated. The line drawings are faultless while for some reason many of the half-tones are reproduced in a rather flat fashion. This book is to be highly recommended to the medical profession and to others interested in sociologic conditions.

R. T. FRANK.

Based upon his method of teaching for some years in the Harvard Medical School, Irving presents *A Textbook of Obstetrics*,<sup>3</sup> moderate in size and clear and concise in text. The book may be accepted as representing the policies and practice of the Boston Lying-In Hospital of which the author is visiting obstetrician.

The book is divided into two parts, Normal Obstetrics, and Abnormal Obstetrics. The first carries the reader logically through anatomy, normal pregnancy, its physiology, changes, hygiene, and necessary antepartum studies. The physiology of labor and the mechanisms of the various presentations follow. There is a discussion of the physician's part in labor, a description of the involutional period changes, lactation and a final chapter on the newborn, discussing the sick and injured infant, written by S. H. Clifford.

Under Abnormal Obstetrics, the author discusses pathology of pregnancy, the pathology of labor, the dystocias, and the accidents of parturition. Obstetric surgery defines and describes the various operations of delivery and reconstruction. The pathology of the puerperium takes up specific puerperal infections as well as other diseases common in the puerperium. The book closes with an appendix of x-ray photographs. There are over 357 illustrations which are well chosen to correlate with the text; a large proportion apparently come from other works. A noteworthy feature of the book is an excellent bibliography following each chapter.

The physiology of conception gives a most recent review of the interglandular hormonal relationship. The influence of these hormones is further discussed in the section on the growth of the fetus and again in the chapter on hygiene of pregnancy. The author emphasizes weight estimation in pregnancy as an index of toxemia, later in the book he refers to excessive weight gain in pregnancy as frequently followed by inertia uteri during labor although he does not explain the correlation. The recent studies of Caldwell and Moloy on the obstetric pelvis are described, and the author gives a very simple classification, later on, of contracted pelvis. The

<sup>3</sup>*A Textbook of Obstetrics. For Students and Practitioners.* By Frederick G. Irving, M.D., Professor of Obstetrics, Harvard Medical School; Visiting Obstetrician, Boston Lying-In Hospital. 558 pages. The Macmillan Company, New York, 1936.

mechanical principles and processes involved in different presentations are well presented, and explained by accompanying black and white sketches.

The author feels that many labors can be conducted with rectal examinations alone. He states that vaginal examinations should be made only when the derived information will prove of benefit to the patient. In the chapter on conduct of labor is a discussion of obstetric anesthesia, the mode of action and the administration of various agents. The author indicates a preference for pentobarbital in combination with scopolamine which, he states, should never be used in the private house on account of the considerable excitement it sometimes produces. He does not, however, suggest a satisfactory substitute for domiciliary practice. Statistically the results of barbiturates in his hands have been unusually satisfactory since there were no failures from the standpoint of amnesia. Under asphyxia the author regards the use of carbon dioxide for resuscitation as irrational based on the finding that the carbon dioxide tension in asphyxia is almost twice that found in normal infants.

The author is conservative in his handling of abortion complicated by fever, refraining from interference except for hemorrhage or well-defined sapremia. All infants weighing five pounds, or less, in the Boston Lying-In Hospital are considered as premature, even though they are born at the expected date of confinement. Low forceps delivery of premature infants is favored as followed by a lower fetal mortality than spontaneous deliveries.

The subject of placenta previa is thoroughly discussed. Under treatments the author has favored conservative measures with vaginal delivery with resulting high fetal mortality and states that a more liberal indication for cesarean section in this condition may be his future plan. In premature separation of the placenta he has had excellent results with rupture of the membranes, the Spanish windlass abdominal binder, and pituitrin.

The author considers three toxic conditions, nausea and vomiting, preeclampsia, and eclampsia. He advises conservative treatment of hyperemesis, but gives very definite indications for interruption of pregnancy. The author does not accept the term low reserve kidney and substitutes a new classification of toxemia from his own clinic. In discussing the termination of pregnancy in preeclampsia there is a rather ambiguous statement as to mortality of cases delivered by cesarean section, which might seem to demand revision. The author devotes considerable space to the pathology and morbid physiology and theories of eclampsia. The treatment recommended is conservative and includes a procedure, plasmapheresis, which the bibliography of the chapter would seem to indicate had not been widely copied.

The section of the Diseases of Circulatory Symptoms written by B. E. Hamilton is an excellent recapitulation of the splendid work done on heart diseases and pregnancy in the Boston Lying-In Hospital.

In the consideration of the contracted pelvis stereoroentgenometry of the head is favored, and there is little mention of pelvic roentgenometry.

The section on operative obstetrics describes in full with explanatory illustrations the technic favored in the author's clinic. Cervical lacerations are repaired only for hemorrhage. The operation favored for posterior position of the occiput is not recommended for other than experienced operators. The high forceps operation has disappeared, statistically. The operation of breech extraction is evidently limited to definite indications and is well illustrated. The author describes and illustrates the technic of various types of cesarean section; he states in Massachusetts one out of every ten women who dies from childbirth causes loses her life following a cesarean section. In the consideration of puerperal infection he favors a generally conservative treatment and feels that there may be some hope in the use of Lash's antistreptococcus antitoxin.

This is a very clear cut and concise presentation of the author's teaching. The subject has been entirely covered in a pleasant manner. There is enough theory

to interest a student, and there is plenty of conservative treatment outlined for the practitioner. The principles and practice elaborated are evidently those which have been thoroughly tested in the mill of a busy obstetric clinic, and on the whole the book deserves a very hearty commendation.

PHILIP F. WILLIAMS.

Devraigne presents in his *Cliniques Obstetricales*<sup>4</sup> some lectures which he has given at the Clinique Baudelocque to students and graduates. These lectures published in different journals have been gathered and present in a collective form various topics of the pathology of pregnancy, dystocia, and the therapeutics of obstetrics in order to emphasize particular points, largely of a practical nature.

There are nineteen subjects handled in this volume which opens with a discussion of prenatal hygiene. Devraigne discusses the subject more from the standpoint of state care of women in relationship between the consulting physician at the prenatal clinic and the practicing midwife in the district, and mentions the importance of having a physician supervise antenatal care notwithstanding the midwife is to be in charge at the time of delivery.

The second lecture is on obstetrical diagnosis and there are three lectures on abnormally situated pregnancies and one on the anomalies of the position of the uterus. Hyperemesis gravidarum, diabetes, colon bacillus infections and pyelitis are well handled. The suggestions as to treatment are much in accord with American practice. In discussing hydatiform mole, he stresses a continuing hormone study of the individual. There are two papers on rupture of the uterus. He refers to the advisability of spinal anesthesia as the most favorable relaxing agent for those circumstances which necessitate rapid vaginal delivery. The indications of low cervical section form the basis of the next paper on dystocia and complications of labor.

The subject of puerperal infection particularly from the bacteriologic standpoint is reviewed under the title of puerperal scarlatina in which reference is made to much of the American work on the streptococcus and scarlet fever. In the concluding lecture he describes treatment of puerperal infection in its general and specific applications, in which he lays stress on protein shock therapy by intravenous injections.

This interesting collection of clinical talks constitutes a current French viewpoint on important obstetrical subjects.

PHILIP F. WILLIAMS.

In the introduction of this the fourth edition of his *Lehrbuch der Geburtshilfe*,<sup>5</sup> Jaschke mourns the death of his former co-author, Otto Pankow who had contributed in the previous editions, physiology and pathology of labor and the pathology of the puerperium.

The volume is a fine example of German bookmaking. There are 573 beautifully drawn illustrations, a great many of which are colored either in whole or in part.

The new material of the physiology and biology of pregnancy has been thoroughly covered in this edition and especially as regards sterility and fertility. In the preface to the book reference is made in a footnote to the fact that the birth rate in Germany since the first half of 1934 has shown a slight upward tendency and the number of abortions have perceptibly declined, phenomena which Jaschke attributes to the influence of National Socialism.

<sup>4</sup>*Cliniques Obstetricales*, par L. Devraigne, charge de cours de clinique annexe de la faculté de médecine de Paris. 240 pages, G. Doin & Cie, éditeurs, Paris, 1936.

<sup>5</sup>*Lehrbuch der Geburtshilfe*. Von Dr. Rud. Th. v. Jaschke. Vierte Auflage, mit 573 zumtheile farbigen Abbildungen. 770 Seiten. Verlag von Julius Springer, Berlin, 1935.

In rewriting the chapters on the physiology and pathology of birth, von Jaschke makes excellent use of roentgen ray pictures of different stages of labor in both normal and abnormal pelvis and in abnormal positions of the fetus. His illustrations adapted from Sellheim's phantom do much to clarify the mechanism of birth. At the present time the Giessen Clinic prefers pernocton as a means of obstetric amnesia-analgesia. The toxicoses of pregnancy are very fully discussed. For hyperemesis gravidarum, von Jaschke uses intravenous glucose, for convulsive toxemia the Stroganoff technic.

The section on operative obstetrics is most complete and beautifully illustrated. The low cervical section recommended follows the technic of Opitz. The chapter on puerperal sepsis and other conditions of the puerperium previously contributed by Pankow has been entirely rewritten. Von Jaschke describes various types of puerperium infections as he differentiates them pathologically. He recommends conservative medical therapy, transfusions, nonspecific protein therapy, and surgery indicated only for localized abscesses. He places little reliance on dyes or other chemicals applied intravenously.

This very fine example of obstetric teaching in Germany may well be regarded as a reference book of unusual worth.

PHILIP F. WILLIAMS.

### Miscellaneous

The title of this impressive work is *Woman*,<sup>6</sup> an historical, gynecological and anthropological compendium. Compendium seems a rather modest description of this encyclopedia presented in three large volumes, which comprise more than 2,000 pages and contain more than 1,000 illustrations.

In 1846, Heinrich Ploss received from the University of Leipzig the degree of *doctor medicinae* on a thesis entitled: "The Origin of Psychoses in the Puerperium." A few years later he began to specialize in obstetrics and published many papers dealing with various obstetric questions. His special interest in ethnologic and anthropologic problems he first manifested in 1870 in a paper on the different methods employed by various peoples in severing the umbilical cord. There followed in short succession, within a year or two, several papers describing: peculiar alterations of the external genitalia by means of mutilating, ceremonial operations; differences in pubic hair among different races; the varying practices of disposing of the placenta, etc. Ploss published in 1884 a small volume entitled: "The Child, in the Custom and Common Usages of Peoples and Races the World Over." In the following year appeared the first edition of the work here reviewed, the renowned *Das Weib in der Natur- und Voelkerkunde*. It was the first exhaustive study ever attempted of woman from the viewpoint of history, ethnology, anthropology as well as obstetrics. In the preface to this first edition Ploss wrote: "I looked upon woman in regard to all her psychologic and somatic characteristics with the eyes both of the anthropologist and the physician." The end of the year 1885 saw Heinrich Ploss's death. The success of his book was truly amazing. Within one year the entire first edition of 1,500 copies had been sold out so that Dr. Max Bartels had to be entrusted with the preparation of the second edition which in thoroughly revised and greatly enlarged form appeared in 1887. Ever since, among the German-speaking profession, this work has been known simply as "Ploss-Bartels." Its unique value as the best and richest source for information on any question pertaining to woman accounts for its wide popularity which has persisted and

<sup>6</sup>*Woman*. By Hermann Heinrich Ploss, Max Bartels and Paul Bartels. Edited by Dr. Eric John Dingwall. With more than 1,000 illustrations in black and white and seven color plates. Three volumes, 2,020 pages. The C. V. Mosby Co., St. Louis, 1936.

increased as editions followed each other from the hands of successive editors, always competently reflecting newly obtained information from foreign lands and all recent scientific discoveries.

Though for very many years medical writers in all languages have been in the habit of quoting from Ploss-Bartels, they always had been forced to turn to the German original. Now for the first time an English version (of the eleventh German edition) is offered by Dr. Eric John Dingwall. It would be a hopeless task to outline here the stupendous amount of varied data and fascinating information presented in this monumental work but without exaggeration the assertion can be made that the work in its present form well stands comparison with such classics of scientific literature as Newton's *Principia* or Frazer's *Golden Bough*.

HUGO EHRENFEST.

This book, the first *Textbook on Child Psychiatry* in the English language, is a splendid contribution on a most difficult subject, a beacon light appearing in what many psychiatrists and practically all pediatricians have regarded as an uncharted sea. The author, most fortunately and wisely, has had daily contacts with pediatricians and the personnel of various child-caring agencies, which must surely have aided in broadening his viewpoint and improved his understanding of the child and his problems, physical as well as mental. In consequence, this work will serve as an invaluable reference book to anyone seeking information on the mental processes of youth. But, weighty as the book is in substance (it has 527 pages) and in contents, our fear is that, being written in the complex, highly specialized terminology of the psychiatrist, it may lose a great deal of its appeal to pediatricians and others to whom psychiatry is only one of the specialties about which he is supposed to have a smattering of knowledge. Nevertheless, its casual perusal is an interesting experience, its closer study should prove an important event in the medical life of the average physician. Certainly it belongs in the library of anyone called upon to advise parents in the rearing of their children.

T. C. HEMPELMANN.

The task of reviewing this book is a difficult one. This *Index of Differential Diagnosis*<sup>8</sup> is a large and forbidding tome of over eleven hundred pages. Your reviewer is prejudiced against indexes, compendiums, and vademecums. An attempt to arrange an alphabetical file for symptoms, or for physical signs, or for treatment has always seemed to him the wrong approach. Anything commendable that the reviewer may say is, therefore, doubly favorable.

In spite of the large number of authors the book has an evenness and uniformity often missing in such collaborations. The fact that the authors are all British may have something to do with this. The British physician can express himself well in the English language. This makes for clarity and easiness of reading.

Some of the objections that an American reader may have to the book are probably based on different attitudes toward the subjects under discussion. Thus there is a long discussion of anemia. This is written by French and makes delightful reading. One is struck by the importance attached to chlorosis. The reviewer wondered how often secondary anemia is due to pyorrhea alveolaris. He missed also any reference to such apparently valid classifications as microcytic and macrocytic or hyperchromic and hypochromic. One who has some knowledge of hematology, and what physician has not, may find the text useful in puzzling situations.

<sup>7</sup>*Child Psychiatry*. By Leo Kanner, M.D., Associate Professor of Psychiatry, Johns Hopkins University. 527 pages. Charles C. Thomas, Springfield, Ill., 1935.

<sup>8</sup>*An Index of Differential Diagnosis* of many symptoms, by various authors, edited by Herbert French, consulting physician to Guy's Hospital. Fifth edition, with 742 illustrations of which 196 are colored, with 1,145 pages. William Wood & Company, Baltimore, 1936.



The subject of jaundice is comprehensively discussed. It is well handled. In mentioning the body fluids that may contain bile the blood serum is not spoken of and no reference made to the icterus index or to the van den Bergh test. One misses any reference to urobilinogen, its ready quantitative determination and its diagnostic importance. Carotinemia is not listed among the conditions that may simulate jaundice.

The pictures, including colored photographs, are, on the whole, good. They add much to the value of the book for one who wants a quick, though often superficial, review of a subject.

The reviewer can recommend the book for one who wants this sort of thing. For those who have access to medical libraries an hour spent there with the standard textbooks and current literature will be more useful.

LLEWELLYN SALE.

The first volume of a new English *System of Post-Graduate Surgery*<sup>9</sup> edited by Rodney Maingot is an impressive tome of 1,742 pages. The paper is excellent, the print large, the illustrations well executed, and the binding is sturdy. This first volume deals with Anesthesia, The Abdomen, The Rectum, X-Ray Diagnosis, and Radium Treatment.

An American Foreword has been written by Pool and a sentence of it may be quoted: "In this work are presented exhaustive discussions on all branches of surgery carefully prepared and edited; and there is the refreshing aspect that they are transmitted to us from across the Atlantic by many minds with which we are unaccustomed to deal." The book is dedicated to Moynihan, of Leeds, who has written an introduction.

The section on anesthesia has been written by Hewer, and discusses the subject first by agents and their action, and second as to their regional application.

Part Two on the abdomen is edited by Maingot. The papers comprising this part of the book are by a list of notable English surgeons. The medical aspects of abdominal surgery are reflected in several titles as "The Investigation of a Case of Dyspepsia," "Jaundice," "Diabetes in Surgical Cases," "The Spleen and the Blood Platelets." The description and discussion of the Pean-Billroth I operation has been written by Finochietto, of Buenos Aires, who is the only non-British contributor to this volume. There is a very complete consideration of the surgery of each abdominal organ, with operative technic well illustrated by photographs and diagrams, and with the pathology exposed by photographs and photomicrographs. This part closes with a nine-chapter presentation of the complications of abdominal operations by Maingot, including one by Wright on post-operative phlebitis.

W. Ernest Miles has contributed a section of 222 pages on surgical conditions of the rectum and anus. This is virtually a monograph of the subject. It may be noted that the mortality of the one-stage abdomino-perineal operation for carcinoma of the rectum in his hands has steadily dropped in three successive series from 32 per cent to 17 per cent, and finally to 10 per cent. His five-year salvage, all varieties included, from recent studies shows a survival rate of 69.3 per cent.

Part IV considers the x-ray diagnosis of abdominal conditions. This section, written by Bull, takes up separately the alimentary and the urinary tracts. This discussion, profusely illustrated by skiagraphs and diagrammatic black and white sketches, takes up the diagnosis and differential diagnosis by x-ray of the manifold pathologic processes of the stomach, intestine, and related organs. The congenital and acquired lesions of the urinary system are as thoroughly considered.

<sup>9</sup>*Post-Graduate Surgery*. Edited by Rodney Maingot, Senior Surgeon of the Royal Waterloo Hospital and Southend General Hospital. Volume I, with 846 figures in the text, 1,742 pages. D. Appleton-Century Company, New York, 1936.

The final part of the book is on radium treatment. Code discusses radium treatment of malignant disease and Donaldson discusses radiotherapy in diseases of women. Code goes deeply into the subject of the principles involved and the action of radium. He describes the biologic effect of this agent and what may be accomplished in various malignancies, with statistics from various surgical clinics of Great Britain.

Donaldson gives an excellent discussion of his subject. He compares the various technics used, the Stockholm plan, the Munich method, the Memorial Hospital method, the Paris technic, in treating carcinoma of the cervix. He states, "When radiotherapy is combined with x-ray treatment the final results are superior to either of these methods of radiation used alone." Fairchild concludes this part with a paper on the High Voltage x-rays in gynecologic malignancy.

This volume is superb in the scope with which the subjects are treated and if the succeeding volumes are of the same nature this system will rank equally with any of the present-day systems of surgery of any other country. For the practicing surgeon this presentation of the English thought and mode should be of inestimable value.

PHILIP F. WILLIAMS.

The *Collected Writings*<sup>10</sup> of Alfred E. Hess appear in two large volumes. Each of them is of more than 700 pages. In spite of this it was necessary to publish 43 articles by title only. This collection was published not merely as a memorial to Hess, but to preserve the continuity and the development of the many subjects in which Hess took such an intimate and prominent part and to which he contributed so freely. There is hardly a discipline in medicine to which he did not make valuable contributions. In addition to the ones with which his name is most prominently connected, may be mentioned his discovery of thromboplastin, a tissue extract for the control of bleeding; his pioneer observation that the vulvovaginitis of children resists treatment because of the coincident infection of the portio vaginalis. Hess was the father of the preventorium in this and other countries to protect children exposed to tuberculosis from further contamination. His main contributions were in scurvy and rickets. He recognized that latent scurvy was of more frequent occurrence than the overt form. He was the first one to understand that the changes in scurvy were due to changes in capillary permeability rather than changes in the blood. His studies on the lability and ready oxidation of vitamin C completely changed the methods of canning vegetables. His studies on rickets are classical. He again brought cod liver oil into prominence, found out the effects of ultraviolet light and discovered that vitamin D can be produced in foodstuffs through irradiation with ultraviolet light.

Altogether this collection with its charming and heartfelt introductory biography from the pen of his lifelong friend, Abraham Flexner, should be generally recommended to the profession.

R. T. FRANK.

This beautiful *tribute to Dr. Henry Asbury Christian*<sup>11</sup> from his admiring and grateful associates and former house officers is dedicated to him on the occasion of his sixtieth birthday. Dr. Vaughn has written an appropriate dedicatory foreword, and Dr. Christian's magnificent service to medicine and especially to the Peter Bent Brigham Hospital is recounted in an introduction.

<sup>10</sup>*Collected Writings*. By Alfred E. Hess. In Two Volumes. Volume I, 719 pages; Volume II, 734 pages. Charles C. Thomas, Springfield, Ill., 1936.

<sup>11</sup>*Medical Papers*; dedicated to Henry Asbury Christian, physician and teacher, from his present and past associates and house officers at the Peter Bent Brigham Hospital, Boston, Mass. In honor of his sixtieth birthday, Feb. 17, 1936.

The text of one thousand pages comprises one hundred and one contributions on internal medicine. Truly as one reads through this wealth of material presented by his former pupils one may well agree that Dr. Christian's outstanding contribution to medicine has been as he himself has expressed it, "the training of men."

PHILIP F. WILLIAMS.

This is an *appreciation of J. Arthur Harris*<sup>12</sup> edited by the members of the Department of Botany of the University of Minnesota. They discuss Harris as a man, Harris the botanist and Harris the biometrician. A small number of the author's contributions to these two disciplines are given. Among these are four which interest the gynecologist and obstetrician. One of these articles deals with the length and weight of the newborn of various nationalities. It is based on 44,000 records of Sloane Hospital for Women in which only uniparous births of the white race and married women are considered. Differences in length to nationalities (7 were considered) is exceedingly small, in the male 1.01 cm., in females 0.60. The Irish were longest, the Italians shortest, the Irish heaviest, the Russians lightest. Another investigation deals with the relationship between the number of pregnancies and the number of births. This is based on 11,000 cases of which 4,596 were foreign born and 6,415 American-born mothers, the fathers always being of the same nationality. Practically no relationship between the incidence and the number of children brought to term could be found.

R. T. FRANK.

Abellan has written a small monograph on *Subcutaneous Symphysectomy*,<sup>13</sup> covering its indications, contraindications, etc. The maternal mortality was 3.2 per cent, the fetal 18.06 per cent.

R. T. FRANK.

<sup>12</sup>J. Arthur Harris. Botanist and Biometrician. Edited by C. Otto Rosendahl, Ross Alken Gortner and George O. Burr. 209 pages. The University of Minnesota Press, Minneapolis, 1936.

<sup>13</sup>La Sinfisiotomia En España. Por Dr. Angel Guerrero Abellan, Barcelona, 1936.

## Society Transactions

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### NEW YORK OBSTETRICAL SOCIETY

*MEETING OF MARCH 10, 1936*

The following papers were presented:

**Incontinence of Urine in the Female. Roentgenograms Illustrating Some Functional Observations of the Injured Urethra.** Dr. William T. Kennedy. (To be published in a later issue.)

**A Consideration of Some of the Aspects of Sterility.** Dr. Gerard L. Moench. (For original article, see page 406.)

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### OBSTETRICAL SOCIETY OF PHILADELPHIA

*MEETING OF MARCH 5, 1936*

The following papers and case reports were presented:

**A Statistical Survey of Eclampsia.** Dr. R. A. Kimbrough, Jr., and Dr. R. M. Shirey. (For original article, see page 415.)

**Palpation of the Fetal Heartbeat Through the Maternal Abdominal Wall.** Dr. Robert J. Griffin. (For original article, see page 515.)

**Bicornate Uterus With Ovarian, Omental and Pelvic Endometriosis.** Dr. Frank J. Frosch. (For original article, see page 490.)

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### CHICAGO GYNECOLOGICAL SOCIETY

*MEETING OF FEBRUARY 21, 1936*

The following papers were presented:

**The Significance of Fetal Heart Tones in Ablatio Placentae.** Dr. Garwood C. Richardson. (For original article, see page 429.)

**Benign and Malignant Polyps of the Cervix Uteri.** Dr. Clyde J. Geiger. (For original article, see page 465.)

**Spontaneously Occurring Painless Labor in Absence of Neurologic Disease.** Dr. Marshall Field.

# Department of Maternal Welfare

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CONDUCTED BY FRED L. ADAIR, M.D., CHICAGO, ILL.

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## MATERNAL WELFARE WORK IN OHIO

A. J. SKEEL, M.D., CLEVELAND, OHIO

THE work in Ohio under the auspices of the Hospital Obstetric Society is essentially on extension of the "Cleveland plan" to cover the entire state. Under the Cleveland plan or group system, a number of hospitals unite to study their obstetric methods and results. We have organized the state into six districts, in each one of which the hospitals act as a group or unit for the purposes of this study. This group study is the pivotal point in the Cleveland plan. Valuable statistics naturally are accumulated as the result of these clinical conferences, but visiting obstetricians from other states, who attend our meetings and then go home to develop a simpler and easier plan for gathering and analyzing sets of figures on maternal and fetal mortalities and morbidities, have missed the vitalizing factor in our organization. Our "group" meeting is an "experience meeting," and its value is due to the interchange of experiences in pathologic cases. The ensuing discussions are essentially "dry clinics" conducted by these leaders for each other's benefit.

Visitors sometimes say, "There is too much professional jealousy in our community for such a plan to succeed." Human nature is the same in Cleveland as it is in Buffalo, Philadelphia, or San Francisco. If the conference is carried on with a sympathetic understanding of the "other fellow's" troubles, suspicion and jealousy are soon replaced by good will and the desire to help.

### HOW TO ORGANIZE A HOSPITAL GROUP

The plan can be carried out successfully in any community having several hospitals within easy driving distance. Large cities, such as New York, Philadelphia, or Chicago, can establish several groups. The organization is one of hospitals, not one of individuals.

Call a meeting of the obstetric staffs of several hospitals and select a chairman and secretary. The chairman should be chosen for his standing and reputation as an obstetrician, and for freedom from commercialism and petty jealousy. The secretary must be willing to carry out the tedious details which will devolve upon him. His devotion to the work can make the organization a success. If he does not function, the whole effort will fail.

Meetings are held every two or three months, depending upon how many cases are to be studied. We have found that ten to fifteen cases can be advantageously considered at one meeting, since about one-half of the puerperal deaths occur before viability, and they receive less detailed attention.

Arrange with the local health office to furnish periodically to the group secretary a copy of the certificates of all puerperal deaths occurring in the locality. Have the secretary forward to each hospital the names and dates of the patients upon whom it is to report, as shown by the death certificates. Each hospital should



then have prepared from the chart, and by personal interview with the doctor, if needed, a detailed report of each case. This report is identified by patient's initials, hospital, date, and case number, so that the secretary can check it against the death certificate. All of these reports should be in the hands of the secretary before the meeting is called to order.

The case report should contain all information necessary for a judgment as to (A) diagnosis, (B) evaluation of care both before and after admission, (C) classification according to our plan.

#### THE GROUP MEETING OR CONFERENCE

After the call to order, reading of the minutes, correspondence, etc., comes the study of the case reports. Upon the ability to elicit discussion and suggestions for better care will depend the success of the group.

The secretary reads aloud the report of the case, without mentioning the name of the patient, the hospital, or the doctor. These should not be identified until after the discussion. Personalities and institutional relations are thus eliminated. The hospital and the doctor may then be named in order to give opportunity for rebuttal of criticism. The doctor often wants to defend the management of the case. Frequently some point, not sufficiently brought out in the history, influenced his handling of the patient. The case is now ready to classify for statistical studies. The classification is adopted after discussion by the group, sitting in judgment, as a jury on the case. Cases before and after viability should be carefully separated, since fatal abortions, ectopic pregnancies, etc., have no bearing on the efficiency of the obstetric department of the hospital. Infections should be carefully differentiated as to whether or not they were acquired in the hospital or before admission. The cause of death as thus established often corrects obvious errors on the death certificate.

The form for classification is one which our experience has shown is well adapted to help in scientific studies, and in attempting to evaluate hospital arrangements and clinical methods for management of patients. We will present this with instructions for its use later. As time goes by, it becomes the duty of the secretary to compile the information thus acquired into statistics which aid in the selection of efficient standards, and point out methods which are deficient. Our conferences broaden the clinical knowledge of the attending obstetricians. They help to break down the isolation of individual hospitals, and to promote friendly relations among the obstetricians of the community. They elevate the obstetric standards of the participating institutions. There is a natural tendency for each to adopt methods which have proved valuable elsewhere. They give opportunity for combined action against harmful practices.

Our State Organization is far from being a completed project. We have at present absorbed only the larger institutions (those with twenty-four or more obstetric beds). About 95 per cent of these are active members. A far more difficult task now confronts us, viz., that of securing the cooperation of the smaller hospitals, and of preparing standards which are useful and practicable for their limited facilities. One of our committees is working on this problem and expects to visit every small hospital in the state during the coming year. Details of what has been accomplished and some of our statistical findings will be presented in a later statement.

## THE NORTH DAKOTA COMMITTEE ON MATERNAL WELFARE

JOHN H. MOORE, M.D., GRAND FORKS, N. DAK.

The North Dakota Committee on Maternal Welfare was organized in November, 1935, as one of the regular committees of the North Dakota State Medical Association. Its present membership is made up of *John H. Moore*, Grand Forks, N. D., chairman, *E. M. Ransom*, Minot, N. Dak., *Paul W. Freise*, Bismarek, N. Dak., *J. F. Hanna*, Fargo, N. Dak., and *John D. Graham*, Devils Lake, N. Dak.

Early in its work, the Committee decided to sponsor as many obstetric meetings before the component District Medical Societies as possible. This plan met with the splendid cooperation of the officers of the various societies contacted. It has been more a question of finding time to put on all the progress requested than of creating a demand for them. The Societies at Fargo, Jamestown and Grand Forks have been visited to date, and Devils Lake and Bismarek are to have committee-sponsored programs in April.

To further the program of professional education in obstetrics, it was decided to ask each District Medical Society in the State to appoint a subcommittee on maternal welfare, to consist of three physicians, one of whom was to be a rural practitioner.

Preliminary arrangements are now under way to hold at least one two-day obstetric seminar during the year, to be conducted by a prominent obstetrician from without the state. The chief subjects to be discussed at this seminar are: (1) Prenatal care, (2) the prevention of infection, (3) the prevention and control of the toxemias of pregnancy, (4) the prevention and management of abortions, (5) breast feeding.

The Committee has had splendid cooperation from *Maysil M. Williams*, State Health Officer for North Dakota. Through the State Department of Health, sterile obstetric packages for home deliveries are to be made available to private physicians requesting them. With the endorsement of the Committee and under the direction of Dr. Williams, a Maternity Nursing Service is to be instituted in one county in the state for a period of one year.

The Committee has stressed the importance of well-equipped, separate obstetric departments in hospitals admitting maternity patients, adequate nursery facilities, and the importance of isolation of any infected patients. The State Board of Administration, which licenses all hospitals or maternity homes in the State, will be asked to check all so-called maternity homes, especially in regard to equipment and whether or not registered nurses are in charge.

To date, eight radio talks on maternal welfare have been broadcast under the sponsorship of the committee. Because of the response to this feature of lay education, it was decided to prepare and broadcast a series of four talks on infant welfare, and this material is now being prepared. Home-makers Clubs in North Dakota are very active and the committee was approached as to the possibility of providing a course of study, dealing with maternal and infant welfare, for club meetings.

The program of the committee is just getting under way in North Dakota. It represents the attempt of organized medicine to meet the demands of the profession and laity for a better understanding of the problems involved in maternal welfare. We believe that one of the chief functions of the committee should be

the placing of emphasis on the personal relationship between patient and physician. Our program is the antithesis of state medicine or of socialized medicine in any form. Only through the personal cooperation of the physicians of the state and the education of the patients to seek the highest type of obstetric service available to them can this program or any other program of maternal welfare succeed. The response to our efforts to date has made us optimistic for the future.

## OBSTETRICS IN INDUSTRIAL MEDICINE

GOODE R. CHEATHAM, M.D., ENDICOTT, N. Y.

(From the Obstetrical Departments of the Endicott-Johnson Medical Service and Ideal Hospital)

THE following is a brief summary of the first 1,000 consecutive deliveries done at Ideal Hospital by the Obstetrical Department of the Endicott-Johnson Medical Service. Its chief interest lies in the fact that these cases were part of the work of a form of industrial medicine. Obstetrics is not usually considered a part of industrial medicine, hence it was thought that at a time when every form of state, group, and social medicine imaginable is being urged upon the profession, the results of this form of industrial medicine would be of general interest.

The series consists of all deliveries done from Feb. 16, 1932, to Aug. 11, 1935 (abortions excluded).

991 mothers delivered 1,000 babies (9 sets of twins)

840 deliveries were nonoperative

160 deliveries were operative

Operative deliveries were:

A. Forceps	125
High	1
Mid	21
Low	103
B. Version	18
C. Cesarean	18

The results were:

*Maternal:*

Mortality (uncorrected)	1
Mortality (corrected)	0
Morbidity (uncorrected)	79
Morbidity (corrected)	41

Morbidity standard was any temperature of 100.4° F. or over for any two days exclusive of the first twenty-four hours.

*Fetal:*

Stillbirths	25
Stillbirths without fetal heart on admission	13
Stillbirths with fetal heart on admission	12
Neonatal	
Babies of any age dying before discharge	36
Babies under 1,500 gm., or 28 weeks of age	19
Babies over 1,500 gm., or 28 weeks of age	17
Total corrected fetal mortality	29

Obstetric complications were not unusual except that Bandl's ring was noted far more frequently than is generally reported. It occurred six times. Whether these were all a true Bandl's ring or were the so-called persistent contraction ring or not is debatable, for none was left undelivered once the diagnosis of a ring was made. The frequency of these rings aroused our interest, and a review of the cases showed that they were not confined to the cases of prolonged labor, and that morphine in the first stage did not prevent them. Pituitrin was not a factor, for it was not used in any case until the second stage had been completed.

Nonobstetric complications were not properly indexed but the following were noted: diabetes mellitus, 2; pulmonary tuberculosis, 1; severe secondary anemia, 3; salpingitis, 7; cardiac failure, 4; hyperthyroidism, 2; mastoiditis, 2; pyelitis, 7; measles, 1 scarlet fever, 1.

The one maternal death was a patient who was seen at the office prior to delivery, suffering from acute catarrhal otitis media. She was referred to the otologist who did a paracentesis. A few days later she was admitted to the hospital in active labor, delivered spontaneously without vaginal examination and without lacerations. She was placed in isolation immediately because of her discharging ear. The otologist saw her and took charge of the ear condition. Nine days postpartum she developed an acute mastoiditis, was operated upon, became worse, developed a brain abscess, and was reoperated upon. She became progressively worse and finally died several weeks after delivery. The baby was discharged from the hospital as a well baby. This case was not considered as a death from puerperal causes.

The series is too small for the individual procedures, with their results, to have any significance.

A study of the results shows a high uncorrected neonatal death rate of 36 per 1,000 total deliveries. This is the big obstetric problem here. Many of the patients work during pregnancy and many are admitted to the hospital in the latter months of pregnancy with labor far advanced. Many of these babies are previsible, yet not stillborn, and many more that are theoretically viable die of prematurity despite incubators, oxygen therapy units, etc. What effect, if any, industry has on premature labor and abortions cannot be accurately determined, but I am fully convinced that in any highly industrialized community where large numbers of women are employed, the percentage of abortions and premature labors, with the attendant loss of many babies, will always be large.

A few very definite obstetric principles were followed in this series of cases, which were all done in a small general hospital. They were: conservative treatment of eclampsia, cesarean section for central placenta previa, frequent and sufficiently large blood transfusions, and a policy of noninterference with labor, unless there were definite indications. This last policy was not rigidly adhered to in the case of low forceps. We do not believe in routine low forceps, neither do we believe low forceps to be as harmful to the baby as prolonged labor. The total operative incident excluding low forceps was 5.7 per cent.

#### COMMENT

This series of cases constitutes over one-half of the total deliveries in this area for the time covered by the series, and accounts for the exceptionally high percentage of hospital deliveries in this area (84.7 per cent for 1935), yet the five-year average maternal mortality here is 5.38 per 1,000 births, and has not been lowered appreciably by this series.

A properly regulated general hospital can be made safe for maternity cases and is to be preferred to the home.

## Items

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### **American Board of Obstetrics and Gynecology**

The next written examinations and review of case histories of Group B applicants by the American Board of Obstetrics and Gynecology will be held in the various cities in the United States and Canada on Saturday, November 7, 1936, and on Saturday, March 6, 1937.

Application blanks and booklets of information may be obtained from Dr. Paul Titus, Secretary, 1015 Highland Building, Pittsburgh (6), Pennsylvania. Applications for these examinations must be filed in the Secretary's office sixty days prior to the scheduled date of examination.

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### **Central Association of Obstetricians and Gynecologists**

The Eighth Annual Meeting of The Central Association of Obstetricians and Gynecologists will be held at the Hotel Statler in Detroit on October 15, 16, and 17. The guest speaker will be Dr. Emil Novak of Baltimore. The profession is cordially invited.

Dr. Ralph A. Reis, Secretary  
104 South Michigan Avenue  
Chicago, Ill.

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### **American College of Surgeons**

At the next annual meeting of the American College of Surgeons to be held in Philadelphia, during the week beginning Monday, October 19, the following program of especial interest to obstetricians will be presented on the opening day at two o'clock at the Bellevue Stratford Hotel.

Presiding, George W. Kosmak, M.D., Editor, AMERICAN JOURNAL OF OBSTETRICS AND GYNECOLOGY.

"The Adequate Care of the Obstetric Patient in the General Hospital."

(a) "From the Standpoint of the Specialized Practice of Obstetrics." Charles C. Norris, M.D., Philadelphia, Professor of Obstetrics and Gynecology and Director of Department, University of Pennsylvania.



(b) "From the Standpoint of the General Practice of Medicine." Walter Brand, M.D., Toledo, Director of Obstetrics, Women's and Children's Hospital.

(c) "From the Standpoint of Analgesia and Anesthesia." Edward L. Cornell, B.Sc., M.D., Chicago, Assistant Professor of Obstetrics, Northwestern University Medical School, Member of Staff, Chicago Lying-In Hospital.

(d) "From the Standpoint of Nursing Care." Clara M. Konrad, R.N., Jersey City, N. J., Assistant Superintendent and Directress of Nurses, Margaret Hague Maternity Hospital.

(e) "From the Standpoint of the Administration." C. S. Woods, M.D., Cleveland, Superintendent, St. Luke's Hospital.

"The Control of Morbidities and Mortalities." John R. Fraser, M.D., Montreal, Professor of Obstetrics and Gynecology, McGill University Faculty of Medicine.

"Graduate Training for Obstetrics." George W. Kosmak, M.D., New York, N. Y.

"The Work of the Committee on Maternal Welfare." Fred L. Adair, M.D., Chicago, Professor of Obstetrics and Gynecology, University of Chicago.

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### Holland Gynaecological Society

We have been informed that the Holland Gynaecological Society at Amsterdam has decided to organize an *International Congress for Obstetrics and Gynaecology at Amsterdam* in connection with its fiftieth anniversary in 1938.

The last International Congress for Obstetrics and Gynaecology was held in Berlin in 1912. Further particulars regarding the project will be published in this JOURNAL.

The Secretary of the Committee organizing the Congress at Amsterdam is Dr. F. C. van Tongeren, University Clinics for Obstetrics and Gynaecology, Wilhelmina-Gasthuis, Amsterdam W.

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### The Second All India Obstetric and Gynaecological Congress

The Second All India Obstetric and Gynaecological Congress will be held in Bombay about December 25, 1937. The following are the subjects selected for the principal discussions: (a) Toxemia in Pregnancy, and (b) Cancer of Cervix. The exact time and program will be announced in due course of time.

## Books Received

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**THE SINGLE, THE ENGAGED AND THE MARRIED.** A treatise on the mutual adjustment for the attainment of happiness in marriage. By Maurice Chideckel, M.D. 268 pages. Eugenic Publishing Company, Inc., 1936.

**THE BABY AND GROWING CHILD.** Feeding and Health Care. By Louis Fischer, M.D., consulting physician of the Willard Parker Hospital, New York City, etc. Illustrated. 260 pages. Funk & Wagnalls Company, New York City, 1936.

**THE TOXAEMIAS OF PREGNANCY.** By Dame Louise McIlroy, consulting obstetrician and gynaecologic surgeon, Royal Free Hospital, etc. 355 pages. William Wood & Company, Baltimore, 1936.

**UROLOGY IN WOMEN.** By E. Catherine Lewis, M.S.(Lond.), F.R.C.S.(Eng.), surgeon to Royal Free Hospital, etc. Second edition. Illustrated. 100 pages. William Wood & Company, Baltimore, 1936.

**FOOD, FITNESS AND FIGURE.** By Jacob Buckstein, M.D., consulting physician in diseases of stomach and intestines, United States Veterans' Bureau, etc. 252 pages. Emerson Books, Inc., New York City, 1936.

**ARBEITSPHYSIOLOGIE DER SCHWANGERSCHAFT.** Von Dr. Med. Fritz Staehler, Oberarzt an der Universitätsfrauenklinik in Frankfurt a.M. Mit 16 Kurven und 17 Abbildungen im Text. 103 Seiten. Verlag von S. Karger, Berlin, 1936.

**VITAMINE DER MILCH.** Dr. Med. Walter Neuweiler, Universitäts-Frauenklinik, Bern. 140 Seiten. Verlag von Hans Huber, Berlin.

**BLUTUNG UND FLUOR.** Von Professor Dr. Hans Runge, Direktor der Universitätsfrauenklinik, Heidelberg. Zweite, erweiterte Auflage, mit 18 Abbildungen auf 117 Seiten. Verlag von Theodor Steinkopf. Dresden, 1936.

**FIRST ALL-INDIA OBSTETRIC AND GYNAECOLOGICAL CONGRESS, MADRAS.** 2nd to 4th, January, 1936. Proceedings.

**LES PROBLÈMES D'ONCOLOGIE.** Tome VII. Édition Médicale d'État D'Ukraine, 1935. (In Russian.)

**THE MARRIED WOMAN.** By Gladys H. Groves and Robert A. Ross, M.D. 278 pages. Publishers: Greenberg, Inc., New York, 1936.

**ENDOCRINOLOGY IN MODERN PRACTICE.** By William Wolf, M.D. With 252 illustrations and 1018 pages. W. B. Saunders Co., Philadelphia, 1936.

**WILLIAMS OBSTETRICS.** By Henricius J. Stander, Professor of Obstetrics and Gynecology, Cornell University Medical College, etc. Seventh edition, a revision and enlargement of the text originally written by J. Whitridge Williams. With 278 illustrations and 1269 pages. D. Appleton-Century Company, New York, 1936.